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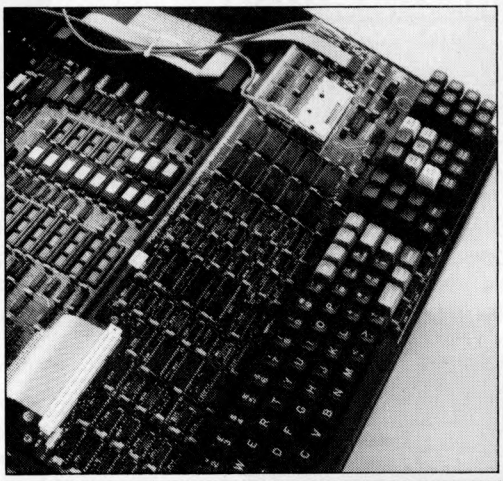

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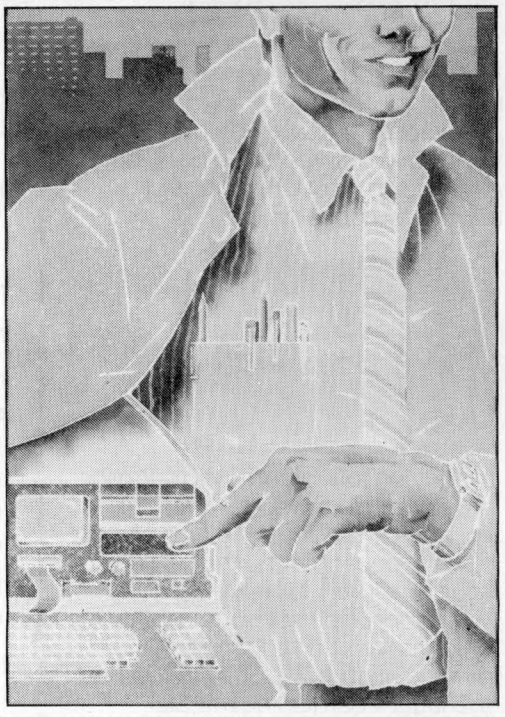

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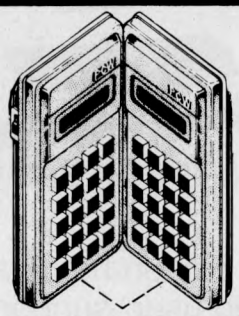

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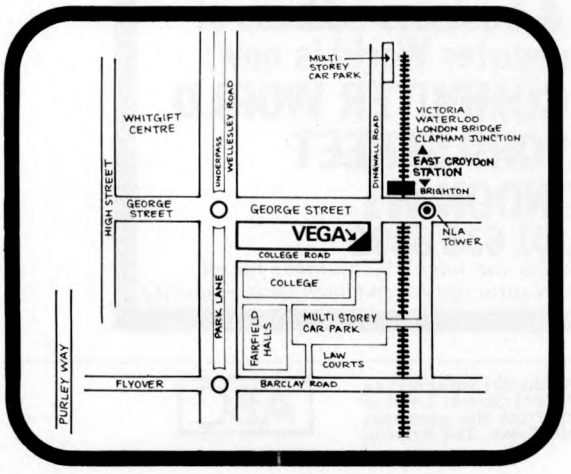

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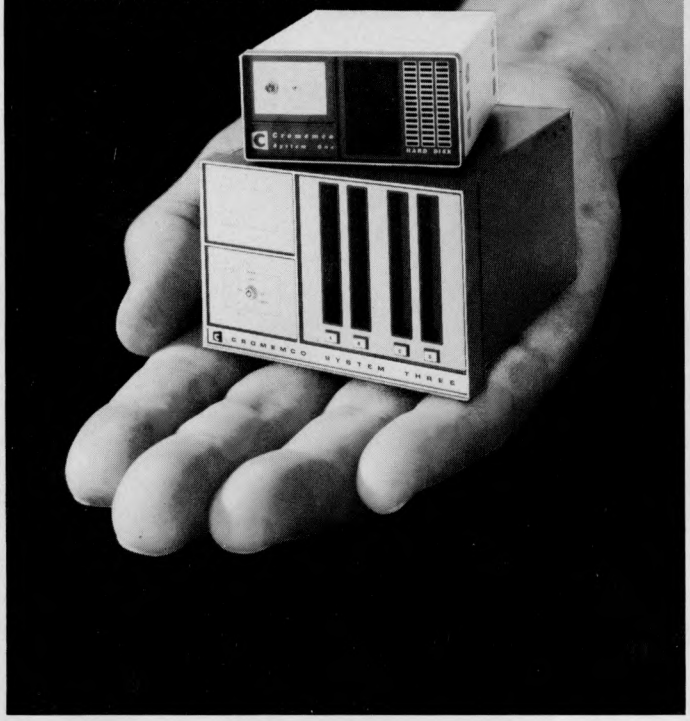
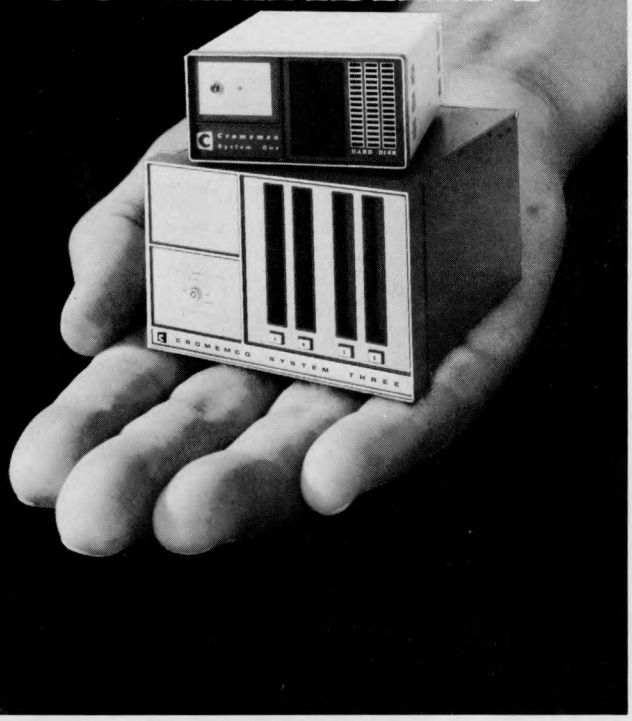
ON THE ONE HAND A 32BIT PROCESSOR AND 16BIT SYSTEM



ON THE OTHER FULL 8BIT COMPATIBILITY



Imagine a microcomputer system which offers all the exciting prospects of full 16 Bit technology to come; but isn't too proud to admit that your existing 8 Bit Software has many years of useful life ahead. So it incorporates the new, high performance MC68000 16 Bit, 8 MHz processor, and an integral software selectable Z80A processor.

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But it takes Cromemco to put promise on the path to reality. So to support MC68000 processing power there is a new concept in memory cards, full S100 **and** IEEE 696 compatibility, and a new software library based on 16 Bit Code to optimise the new found processing power.

The Memory Storage comes in single 256K or 512K cards with built in error detection and correction. That gives a full 4MByte of high speed memory in a Cromemco 16Bit System 3, with internal space to spare. The S100 and IEEE 696 compatibility offers the widest possible options in add-on facilities and interface requirements.

The new software library is comprehensive. There is a 16 Bit version of the proven Cromix Multiuser operating system, (now it will support up to 18 users or tasks). There is a new Fortran 77, designed for creating larger programs in a science/engineering/research environment, and COBOL, PASCAL and 'C', a Structured BASIC, and a 68000 Assembler.

Overall the Cromemco 16 Bit Systems extend the existing boundaries of microcomputer application. In particular, they offer the Scientist and Engineer the opportunity to dramatically reduce the cost of performing the complex mathematical functions required in multi dimensional design, simulation and analytic processes. What was once mainframe capability and became mini is now decidedly Cromemco Microcomputer capability.

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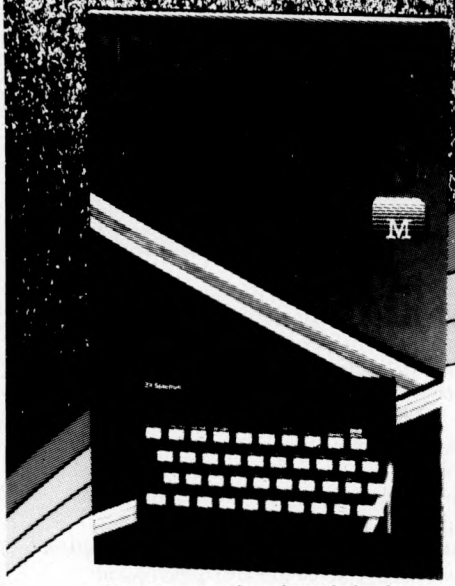

Dr. Ian Logan is the acknowledged leading authority on Sinclair computers. In this book, he gives a complete overview of the way the Spectrum operates, both for BASIC and machine language programming. A special section on the ROM operating system will give you insight into this computer as well as provide you with information on how to use many of the routines present in the ROM. This book is a must if you are serious about programming the Spectrum. Only £7.95.

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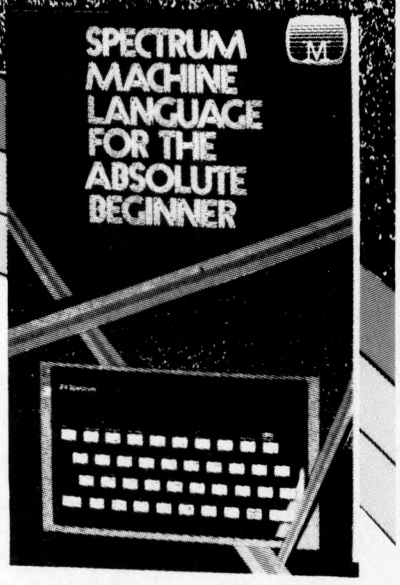

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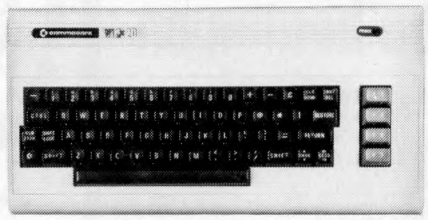

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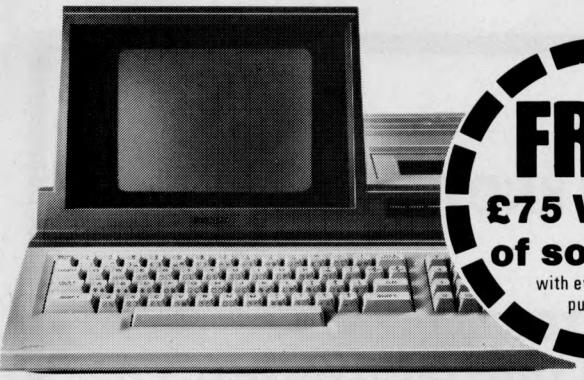

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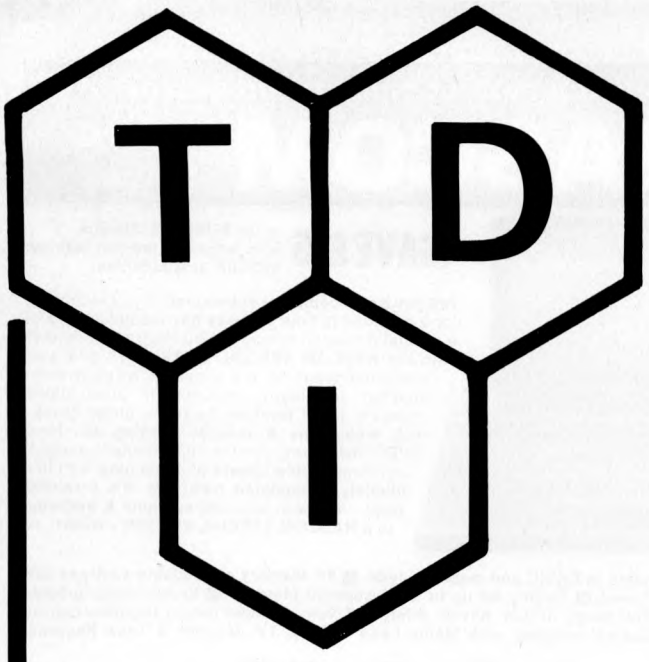

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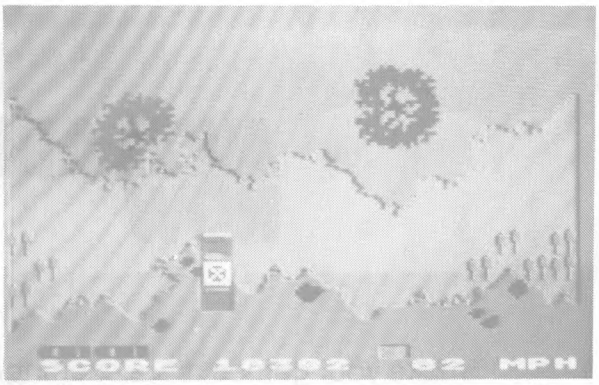

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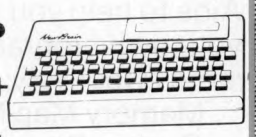

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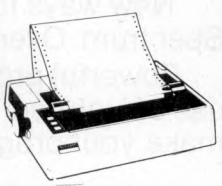

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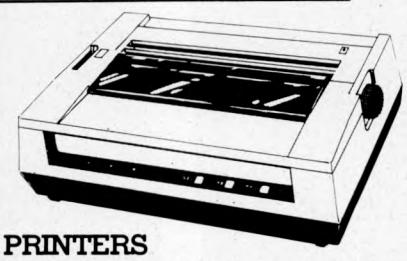
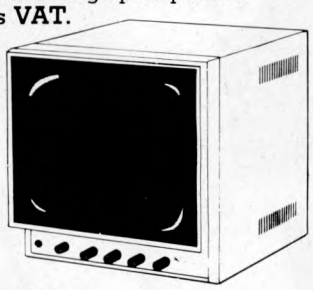


PRINTERS

The EG 3085 is quiet, fast and efficient. Printspeed is 100 characters per second and printing is bi-directional at 80 or 136 characters per line. Suitable for use with other systems, it has three typestyles, adjustable pin or friction feed and single sheet or roll paper facilities. **£425 plus VAT.**

If you don't want to pay that much for a printer, consider the EG 603. It doesn't match the EG 3085 in certain areas, but you will still get 100 c.p.s. bi-directional, a range of character styles, forward and reverse feed and pin/friction feed, with 96 characters and 64 graphic patterns. **£235 plus VAT.**



MONITORS

Available in 9" and 12" sizes, with white, green or amber display, Lowe A.V.T. monitors are sturdy, attractive, easy to operate and feature an easy view screen with smoked anti-glare display filter. Compatible with most popular micros on the market. **From £75 plus VAT.**

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Beat the dirt, coffee spills and sticky fingers when your computer and monitor are not in use with these top quality black leather covers.

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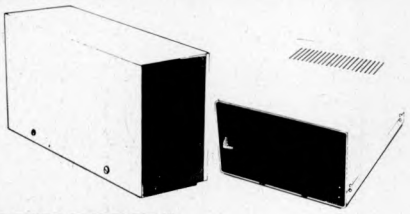


DISK DRIVES

If you want fast, reliable program storage, true random access file handling and access to many computer languages, we can meet your needs. The EG 400T provides storage of up to 184320 bytes per floppy disk and comes complete and tested, in a stylish colour matched cabinet. **£220 plus VAT.**

The EG 401 AT offers dual disk drive with 368640 bytes of useable storage and comes complete with a power supply ready to connect to an expander box. **£365 plus VAT.**

DOUBLE DENSITY ADAPTOR

Allows the use of standard minidisk drives in double density, with virtually double the storage capacity. The EG 3021 is equally at home in the Genie or TRS-80 expander boxes.

A double density disk operating system will be needed, such as smalLDOS provides. **£72 plus VAT.**

EXPANDER BOX

The updated EG 3014 expander box allows for up to four disk drives with optional double density. It connects to a printer, or RS 232 interface, or S100 cards. Not bad value at **£190 plus VAT (16K version) or £200 plus VAT (32K version)**

*The EG 3014 will work with TRS 80 by using the EG 3023 Tandy Adaptor.

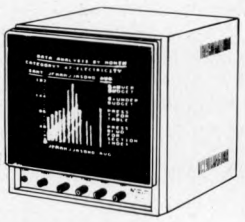
TECHNICAL MANUALS

Full technical details of Genie Hardware (all you ever wanted to know about Genie).

Genie I/II Technical Manual
£10 - No VAT.
Expander and accessories (EG3014)
£10 - No VAT.

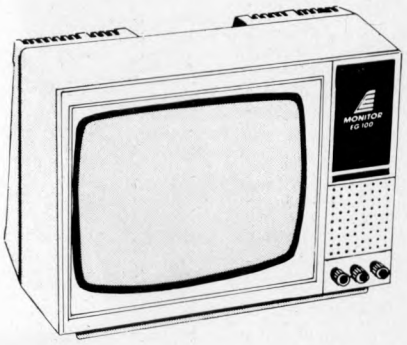
smalLDOS

Powerful, yet reasonably priced, the Genie smalLDOS contains 21 library commands, 7 utilities, LBASIC, disk basic and bags of information, including a reference manual and 40 page beginners guide to disk usage. **£35 plus VAT.**



HIGH RESOLUTION GRAPHICS

Increase graphic resolution capabilities on your Genie seventy-three fold with the LE18 HI-RES unit. It offers bit image graphics of 73,728 points, a resolution of 384 x 192, and uses a separate 16K of video memory to achieve its resolution. Graphics are intermixable with text or existing pixtel graphics, and animation, reverse video displays and use of programmable graphic characters are possible. **£86 plus VAT.**



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Two good performance, low priced 12" monitors, either to match your Genie or compatible with a wide range of other systems. Good resolution and band width and, of course, they free your television set for the other type of programmes you like to watch!

The EG 100 12" in black & white costs **£69 plus VAT.**
The EG 101 12" with green phospher is **£79 plus VAT.**

BUSINESS SOFTWARE

Specifically written for the Genie II computer, with disks and a suite of packages from the renowned house TRIDATA. The suite includes SALES LEDGER, PURCHASE LEDGER, PAYROLL and STOCK CONTROL. Each package is a very reasonable **£175 plus VAT.** Full details are available on request.

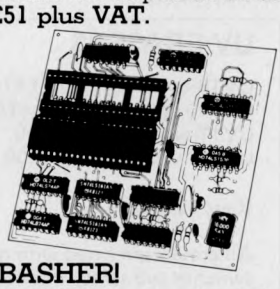
SYSTEMS DESK

Even a compact modular computer system like the Genie benefits from being used on a custom designed system desk. The SD-1 system desk is designed to accommodate a complete Genie System and has a special upper shelf to support the display monitor at the best level. The desk is flat packed for easy delivery and finished in attractive teak and charcoal colours. **£81.40 plus VAT.**

FRED MUSIC SYNTHESISER

Beethoven might well roll over at this stereo music synthesiser: it can produce six simultaneous notes over the whole audio range and provide sound effects. FRED comes complete with a software compiler, full instructions and a demo tune.

It is simply plugged onto the Genie 50 way bus and has two outputs for an audio amplifier. **£51 plus VAT.**



EG 3203 TANDY-BASHER!

If you are a TANDY user, read on! The EG 3203 is bus converted to allow Genie peripherals to be used with Tandy Model I computers. **£18.40 plus VAT.**

(Just in case there might be a few strange souls who want to convert in the opposite direction, there is the 50/40 converter which generates a Tandy compatible 40 way bus from a Genie.) **£34 plus VAT.**

EG 3016 PARALLEL PRINTER INTERFACE

The EG 3016 is a simpler interface allowing a Centronics parallel compatible printer (EG 603, EG 3085) to be connected directly to the Genie keyboard without the need for an expander box. **£38 plus VAT.**

BUS EXTENDER

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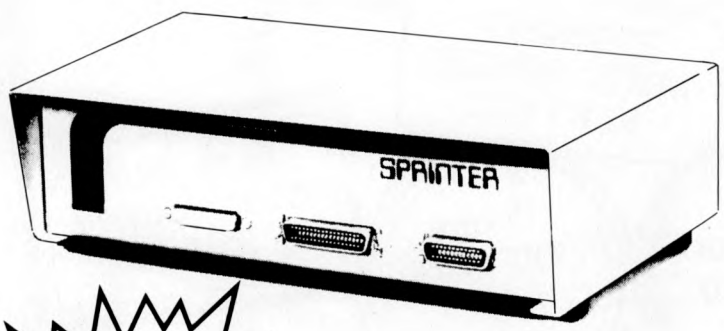

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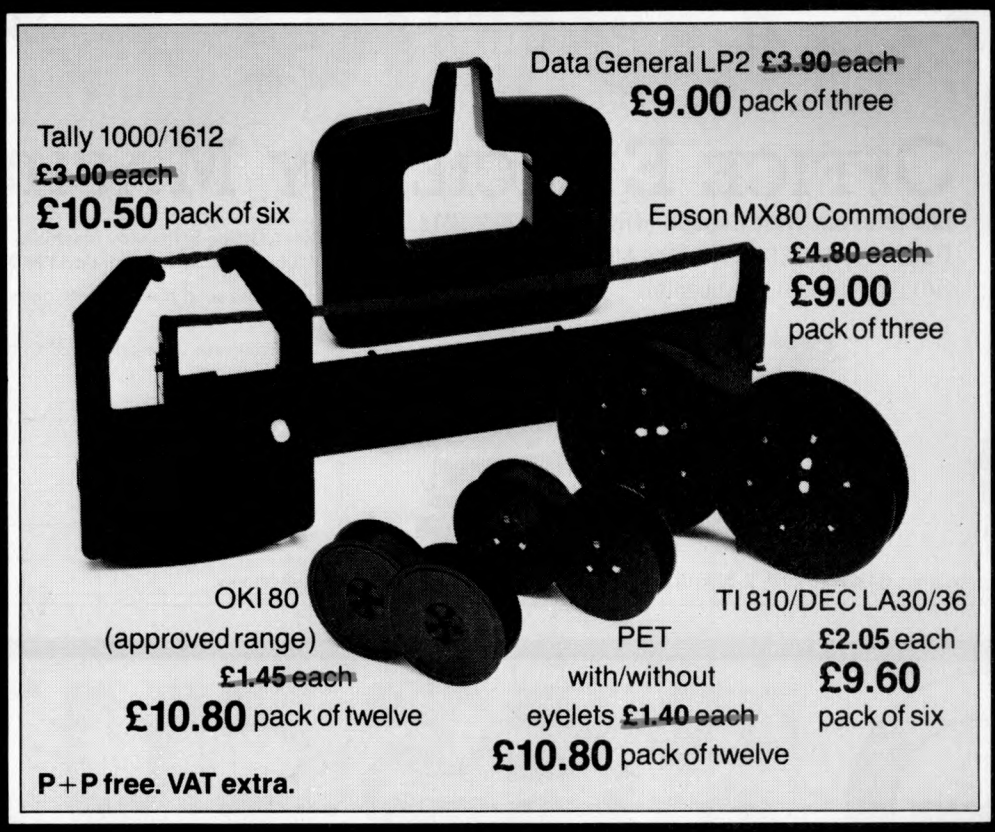

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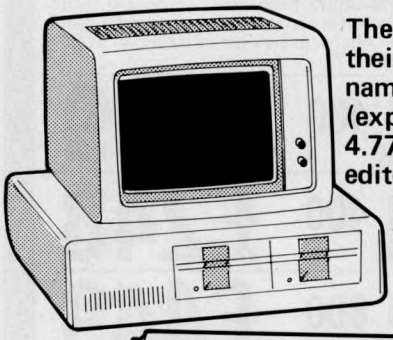

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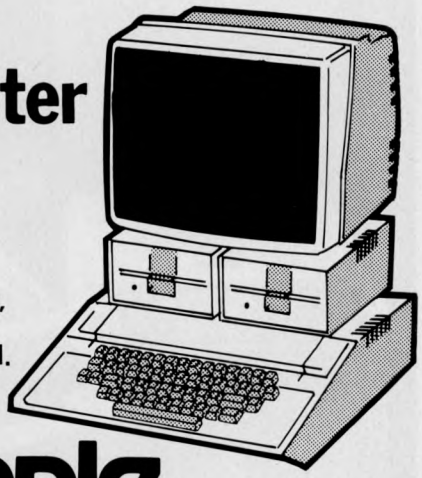

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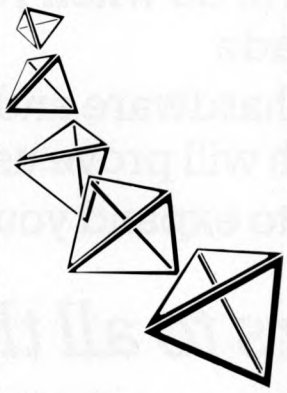

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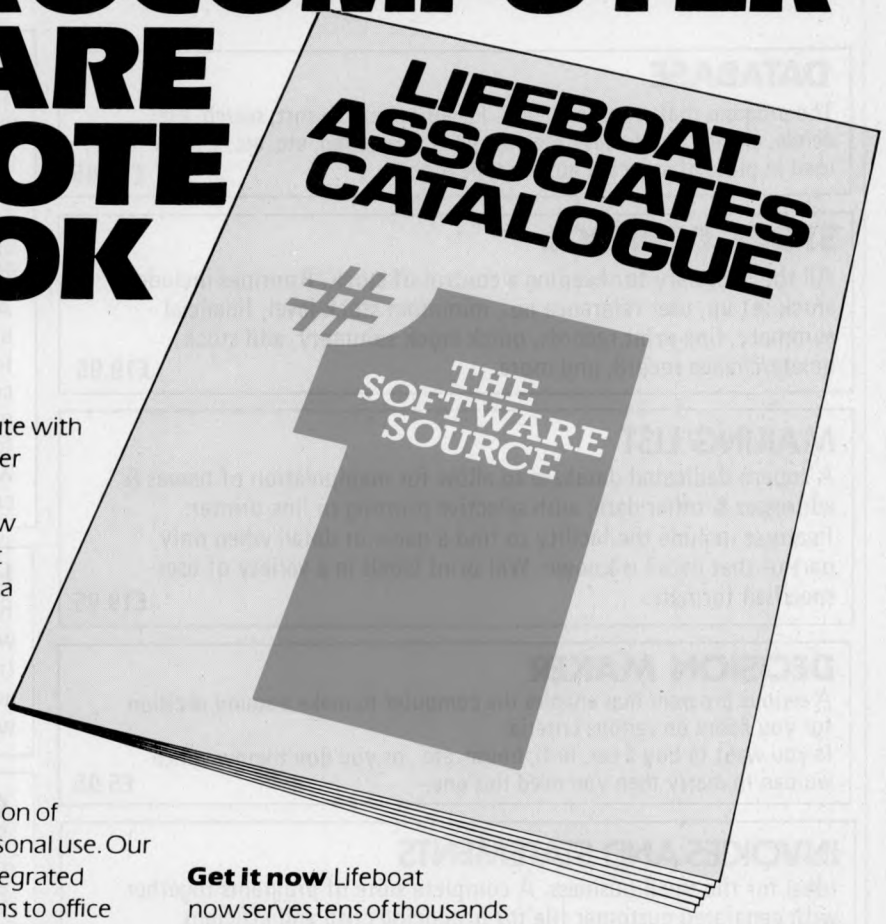

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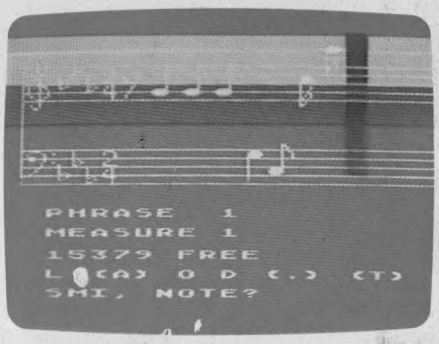

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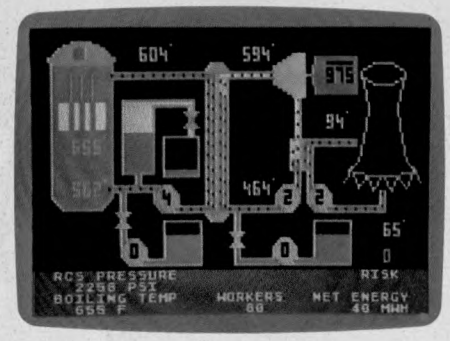

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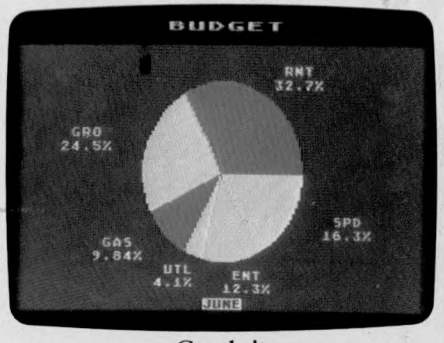

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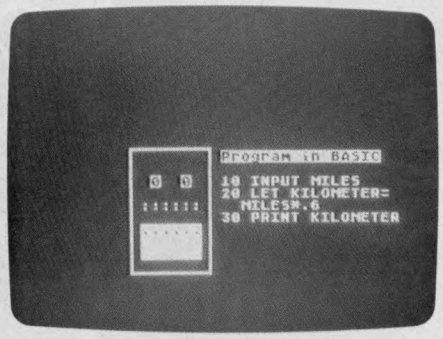

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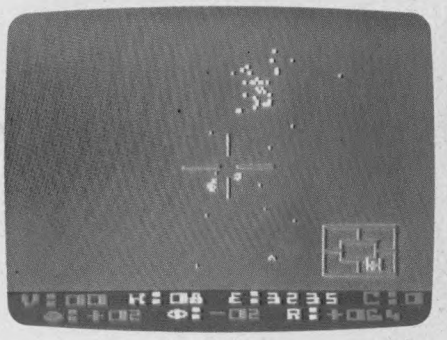

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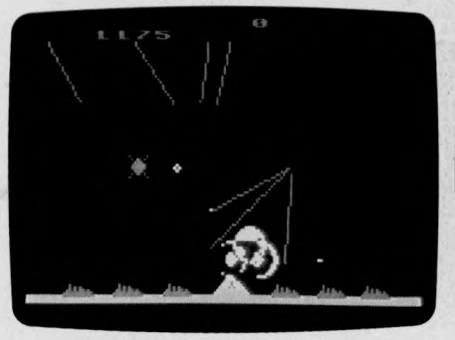

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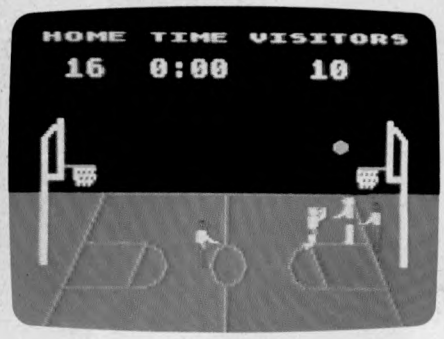

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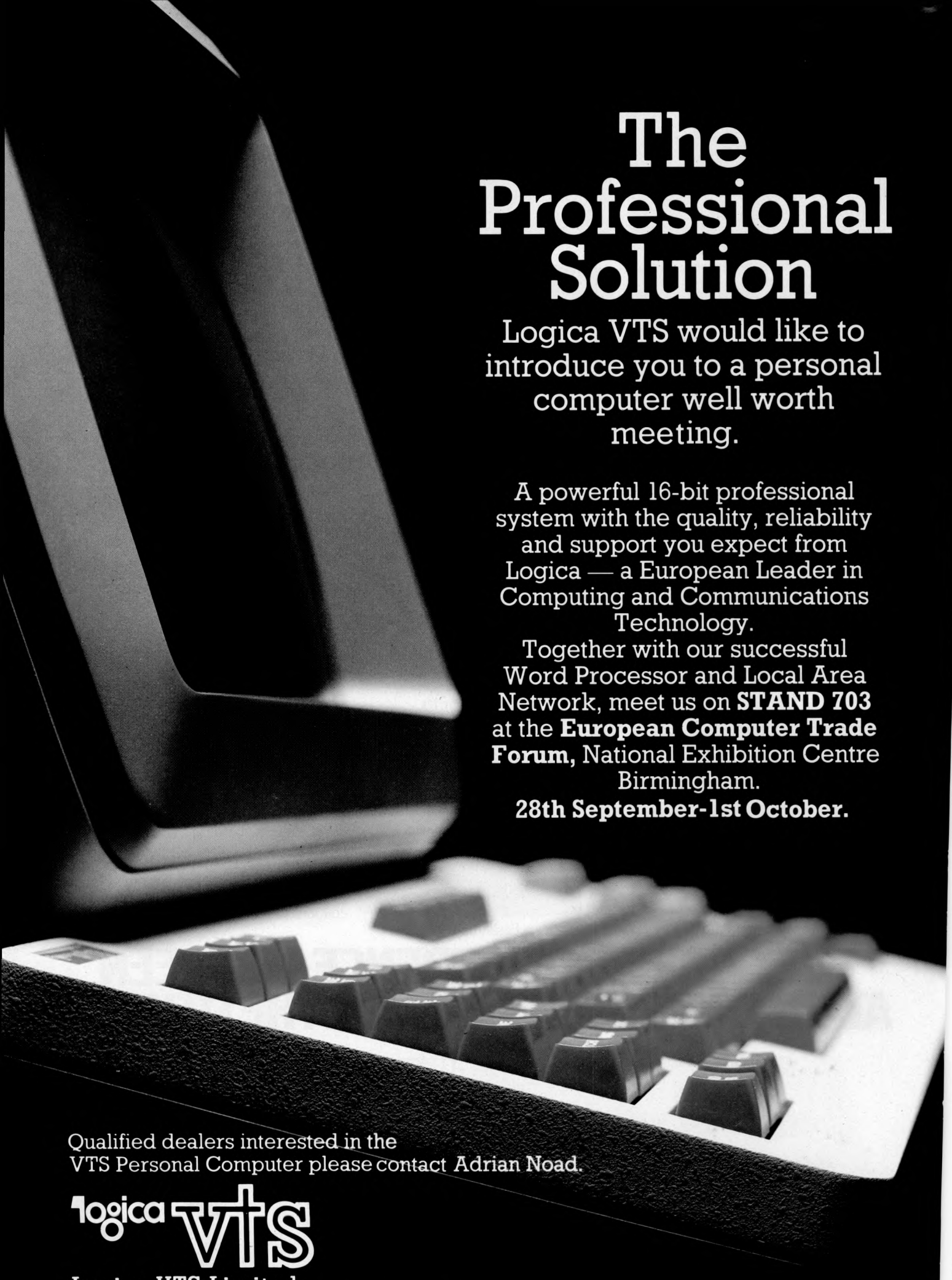

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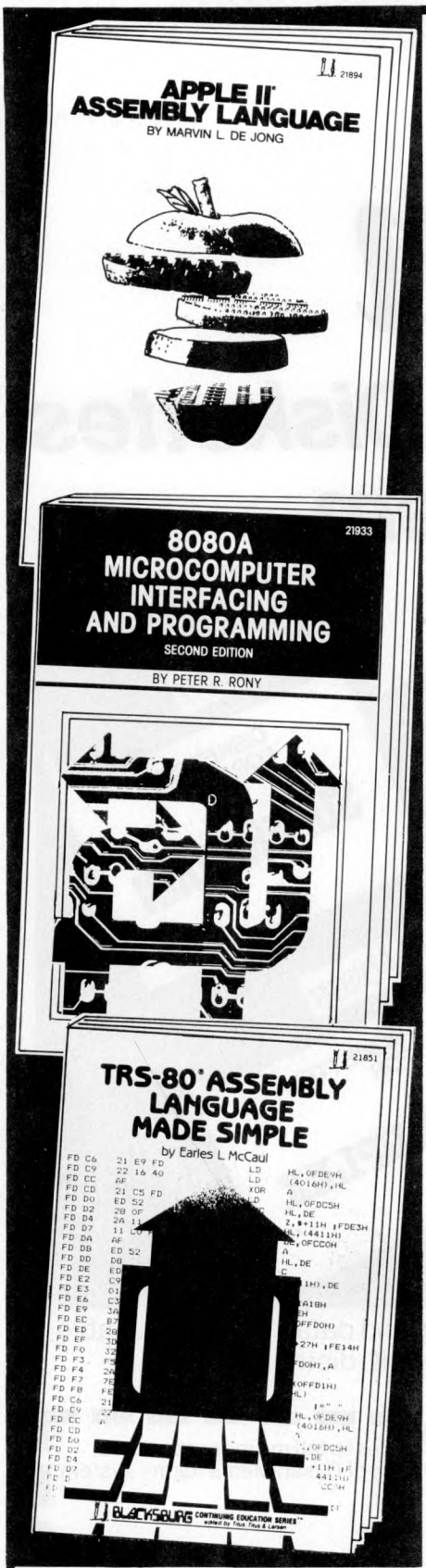

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with the features you need for TODAY and TOMORROW

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*128K ram

*8035 keyboard processor

*S-100 slots

*Green phosphor high resolution screen

*Integrated floppy & winchester disc drives

*Detatched ergonomic keyboard

The Vector 4 is an advanced 8/16 bit desk top computer.

It allows you to take advantage of the existing 8 bit CP/M programs while also providing 16 bit processing power.

The future is built into the Vector 4 with its Z-80 and 8088 processors, 128k of main memory (expandable to 256k), 3 S-100 expansion slots and standard software facilities with high resolution graphics that are second to none. Floppy disc and hard disc systems are available. Nationwide sales and servicing.

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FOR TOMORROW'S SYSTEMS TODAY

SPECIFICATIONS
6809E MICROPROCESSOR. Pet, Apple, Atari 400, BBC Micro, and VIC 20 still have the less powerful 6502.
32K RAM (as standard). At least twice the power of similarly priced machines. Expandable to 64K RAM.
EXTENDED MICROSOFT COLOUR BASIC (as standard). Featuring: ADVANCED GRAPHICS (set, line, circle, paint, print, draw, rotate and print using). ADVANCED SOUND 5 octaves, 255 tones. AUTOMATIC CASSETTE RECORDER CONTROL. FULL EDITING with INSERT and DELETE.
9 COLOUR, 5 RESOLUTION DISPLAY.
USE WITH ANY U.H.F. TV and/or separate P.A.L. monitor.
PROFESSIONAL QUALITY KEYBOARD. Typewriter feel. Guaranteed for 20 million depressions.
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Learning how to use the Dragon 32 won't cause you to experience any problems. Learning what you can use it for will cause you to experience something entirely different.

Delight. Surprise. Fascination. And challenge.

The Dragon offers a range of some of the most popular computer games in the world. From those celebrated space battles to mind-boggling adventures in seemingly unfathomable dungeons and caves.

As if by magic, a simple typed message will command the Dragon to create your own drawings. Then it will colour and paint them in 9 colours.

And it's clever enough to create virtually any image you want - circles and arcs as well as straight lines.

The Dragon will also play and compose music with you, with a range of 5 octaves. And it works with any UHF TV or PAL monitor.

LEARNING THROUGH PLAYING.

All of this makes the Dragon the ideal machine to build your children's interest in the world of computers as they become increasingly more vital. School-children already enjoy using computers.

The Dragon is the first computer specifically for the family - so by enjoying yourselves at home, you and your children can soon become expert enough to create your own programs.

PRODUCT / FEATURE	DRAGON 32	SINCLAIR SPECTRUM	ACORN ATOM	VIC 20	TI 99/4A	BBC MICRO 'A'
PRICE	£199	£125	£175	£190	£199	£300
STANDARD RAM SIZE	32K	16K	8K	5K	16K	16K
STANDARD AVAILABLE RAM FOR HIGH RESOLUTION GRAPHICS	26K	9K	N/A	N/A	14K	3K
EXTENDED MICROSOFT BASIC AS STANDARD	YES	NO	NO	NO	NO	NO
PROFESSIONAL-TYPE KEYBOARD	YES	NO	YES	YES	YES	YES

BRILLIANTLY SIMPLE GUIDE.

The Dragon is living proof that you don't have to be an expert in computerspeak to be an expert in computers. It comes with the easiest-to-understand instruction manual ever written for a home computer.

Every step, every explanation, is made clear - even if you're a beginner. In minutes, it will show you how to write a simple program. Within hours, you'll be fascinated. And from then on, you'll continue to be astounded by the new world which the Dragon's power and versatility will open up to you.

See the new Dragon 32 in your High Street. At under £200, it's not just the first family computer. It also has all the features an expert could wish for.

Except perhaps the jargon.

DRAGON 32

The first family computer.

To: Jean Webster, Dragon Data Ltd, Queensway, Swansea Industrial Estate, Swansea, Glamorgan SA5 4EH.
Tel: 0792 580651.

Please send me further information about the Dragon 32.

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PCW

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The new Dragon 32. So well designed, you'll even understand this ad.

If you're already a computer expert, may we refer you to the box of technical specifications displayed opposite.

If you're not, may we refer you to the new Dragon 32 Family Computer. A computer so easy to understand, you won't understand why all the others seem so difficult.

And the new Dragon 32 costs under £200.

32K RAM FOR UNDER £200?*

When you're comparing computers, the first thing you need to know is the size of the memory. In plain English, the Dragon has approximately 32 thousand units of Random Access Memory. (32K RAM for those who prefer to be blinded by science.) This means that the Dragon's memory is at least twice as powerful as its competitors.

With a memory this powerful, the amount of information the Dragon can store is literally vast. But the Dragon doesn't just make it easy to store information. It makes it easy to use, too.

USER-FRIENDLY?

You may have heard of the term 'user-friendly.' Reverting to plain English once more, this means simply that the computer will go out of its way to understand you, rather than vice-versa.

The Dragon 32 is so user-friendly, it practically licks your hand.

You tap (literally) its vast resources through a beautifully-designed keyboard that's as easy to use as a typewriter.

On this keyboard, you type in a language which is surprisingly close to the English you talk every day. The Dragon 32 will receive your order. Understand it. Send it to the appropriate section of its massive brain. And then display the appropriate information on your screen. All before you can say 'gobbledygook.'

*TV not included in price.

North Star's ADVANTAGE is easy to see.

The best value in microcomputing.

The North Star ADVANTAGE is the perfect low cost microcomputer for business or personal use. With 720Kb of floppy disk storage, or an optional 5Mb Winchester disk, the North Star ADVANTAGE offers the most memory in its price/performance class. And it comes with advanced business graphics software at no extra cost. You can look everywhere, but you won't find a better microcomputer for the money.

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The North Star ADVANTAGE system offers high speed computing based on the Zilog Z80A® microprocessor, the most accepted 8-bit microprocessor in the world, plus an Intel 8035 auxiliary processor. 64Kb of RAM main memory delivers fast program execution, with an additional 20Kb of RAM for the graphic display. North Star provides graphics software compatible with CP/M® and HDOS operating systems and application packages, and most standard languages. There are thousands of CP/M compatible software programs available throughout the world. Or you can choose any of the North Star application packages available for word processing, financial analysis, accounting and data base management.

Graphic displays for every need.

The free North Star ADVANTAGE BUSIGRAPH™ package makes it possible to generate line, bar, pie, and 3-dimensional charts, plus complex 3-dimensional forms. Reports can be transformed into impressive hard copy graphic displays in a matter of seconds.

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One North Star ADVANTAGE computer can be linked to other North Star ADVANTAGES by twisted pair cable using North Star's new network interface and software package. This allows you to have a low cost network of individual systems sharing the more expensive peripherals. This can be the first step toward fully automating an entire office or department.

Convenient design and service.

The North Star ADVANTAGE is a fully integrated microcomputer in an attractive, integrated enclosure. It provides high reliability and excellent operator comfort, plus straightforward servicing. For more information about the North Star ADVANTAGE, contact...

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D-8000, Munich 81,
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The programme guide

Stock control, order processing, invoicing, statement production, payroll, general accounting . . . these are most of the jobs that a business will tackle every day. GRAFFCOM's Integrated Small Business Software packages – ISBS are designed to get these jobs done better and faster. ISBS can improve your productivity and give you better management control over your business.

For the smaller business user with a twin floppy disk based system, ISBS-F is the ideal starting point. A truly integrated accounting approach, the system offers simplicity of use without trade-offs in facilities. In fact most of the ISBS-F features can be found in mini and mainframe systems.

Companies with large data volumes and multiuser requirements should look at ISBS-W. The system supports multiple workstations and is designed to take full advantage of the latest hard disk storage based systems. As you would expect, ISBS-F users can easily convert to ISBS-W when the business expands through the System Migration Plan – SMP.

GRAFFCOM's software products have been designed for most CP/M, MP/M based microcomputer systems. All packages are supplied with comprehensive documentation and backed up with technical support, and maintenance to cover legislative changes. In addition there are products such as accounting guides and graphics programs available to complement and complete our service to the commercial user.

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GRAFFCOM

ISBS-W

A totally integrated suite of software designed for microcomputers which use Hard disks or Winchester disks. The user can choose from any combination of modules and add others at a later stage if required.

1.0 Business Controller

The business control module acts as a task manager and supervisor for all users and mainfile updates. Operators will feel at ease with the menu prompting when selecting tasks such as order processing, invoicing, accounting modules and word processing. The controller is used to set the system parameters, typically the number of disk units and sizes, number of printers, password and authorization codes. You can develop your own application modules for those special jobs and have them incorporated in the business control menu.

2.0 Accounting

The system offers a comprehensive range of facilities to meet the most demanding accounting applications. The modules cover tasks such as sales and purchase ledger, payroll and nominal ledger. Management reports including the P/L and Balance sheet can be produced from the data captured by the system. Audit trails are produced for all transactions entered, with batch totals where applicable. In addition to the main accounting reports, pre-printed output includes statements, cheques and remittances, and also payslips and bank giros.

3.0 Stock & Order Processing

Stock levels can be checked quickly using the on-line enquiry module, and the operator can also allocate stock if required. Order processing allows orders to be entered and maintained until all items and quantities have been shipped. Invoices and order acknowledgements can be produced on line if required with automatic release of stock and drawdown from the orders file. Pre-printed invoice stationery can be used and the layout can easily be modified using the built in formatter.

4.0 Word Processing

To complete the suite, the word processing module offers one of the most sophisticated systems found on today's microcomputers. It includes all the standard features that you would expect to find in a WP system, such as tabs, justification, margins, global search and replace, proportional spacing etc. In addition there is a merge document option to produce those personalised mailshots and labels, and also a built in spelling checker with a 10,000 word (expandable) dictionary.

Ring Round 2220

ISBS-F

ISBS-F is a comprehensive system designed for first time users of floppy disk systems. It can be fully integrated or each module can be used individually, adding others at a later date, which makes it an ideal choice for the first time user.

1.0 Stock Control

The programme allows fast interrogation of any stock line and produces 11 comprehensive reports to achieve optimum stockholding. Amongst the many features, including stock updates, release and goods inwards, the system has the option to define stock groups allowing for parts explosion.

2.0 Order Entry & Invoicing

Invoices can be produced quickly and easily, either by referring to an order already entered, or by entering data at the invoice stage. If necessary, part orders can be sent, as the system can keep track of each order until it is completed. Release of stock and posting of invoices to the Company Sales System is carried out automatically.

3.0 Company Sales System

Customers can be set up as open item or balance forward accounts, and statements can be produced easily at anytime. An online enquiry and comprehensive credit control reports allow you to monitor customer credit limits and help maintain a healthy cash flow. The system can handle part payments and unallocated cash, and produces a full audit trail of payments received.

4.0 Company Purchases System

Target payment dates can be assigned to each supplier invoice, to plan cash flow and to help speed payment procedure. There are reports to show ageing of invoices and the system also has the facility to print cheques on preprinted stationery or payment advices on Company letterheads.

5.0 General Accounting System

The main feature on this programme is the flexibility of the cost code system, which allows you to design final Company reports such as the Profit and Loss Account and Balance sheet. Comprehensive budget reports can be produced, showing any variances between budget and expenditure for your own chosen accounting period.

6.0 Payroll

Employees can be paid by cheque, cash or bank giro transfer, on a weekly, monthly or hourly basis, depending on the Company requirements. The system is fully maintained and incorporates all new legislation. Some of the facilities include overtime, holiday pay, coin analysis reports, and production of P11/P60 forms at year end.

7.0 Names and Addresses

Names and addresses of customers and suppliers together with any others you may wish to keep a record of, can be stored centrally in this system. Names are retrieved by the programmes for completion of invoices, statements etc., by use of an id code unique to each name. A report generator allows you to design and store your own reports.

NEWS RELEASE

LATEST SYSTEMS FOR ISBS-F

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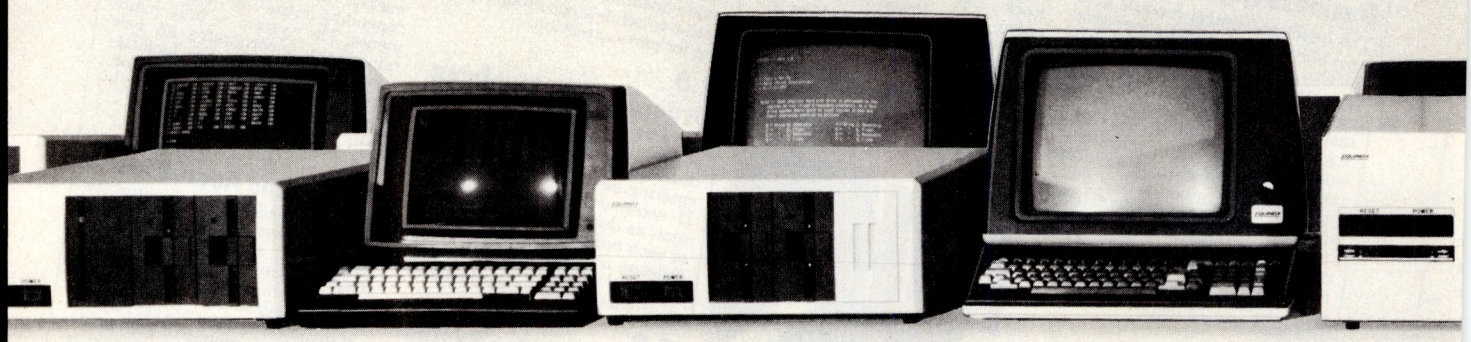

Through their powerful multi-processor operating systems Equinox professional microcomputers will grow and adapt in step with your Company.

Widely used in industry because of their proven power, reliability and expandability, Equinox systems are one of the few Government (CCTA) approved microcomputer systems with both CP/M and MICROCOBOL as standard.

And because they are specifically designed to grow and adapt with you, Equinox microsystems will win your approval, too.

EXPANDABLE

Equinox systems are not just simple desk-top, single-user machines, so they can expand both storage capacity and number of users, and grow from single-user floppy based (5¼" or 8") to multi-user hard disc systems.

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What's more, with Equinox you can choose from a wide range of packaged software available: accounting, word processing, financial planning, information (data base) management and many others – or write your own application programs.

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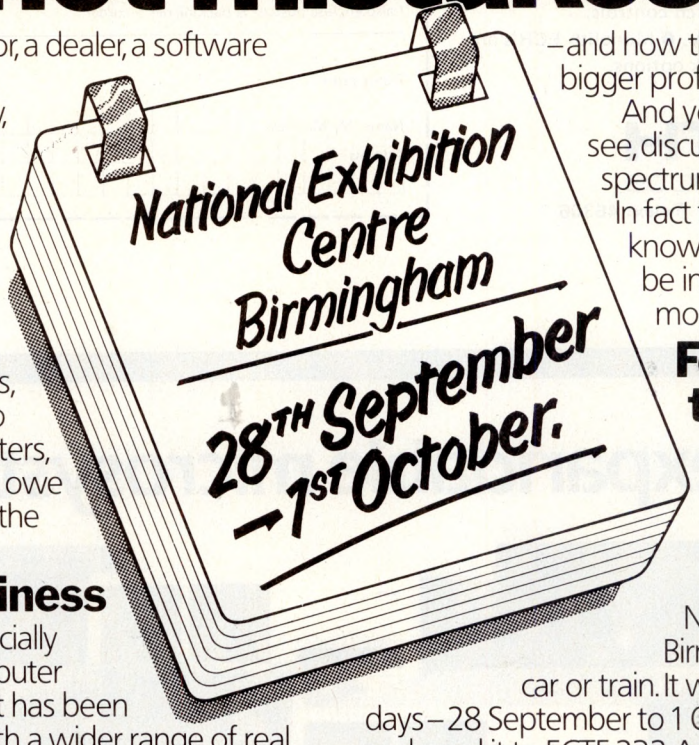

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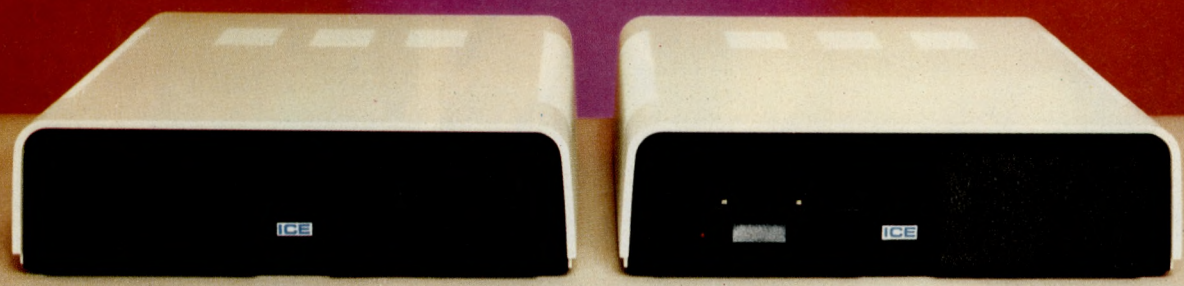

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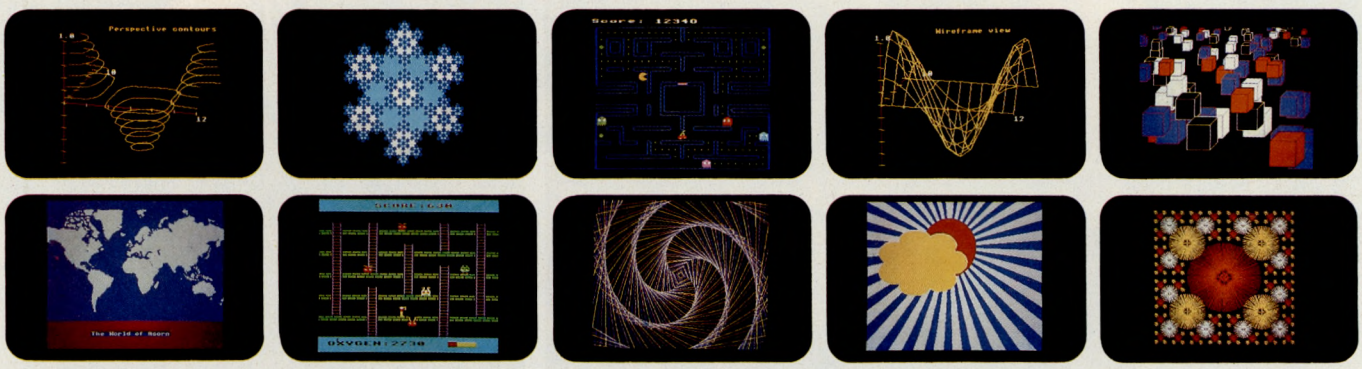

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But first things first, what's new about the Caltext

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Word Processor?

Well, it's got the same easy to use and understand function keys that made us welcome in the beginning.

But now it's also got an in-built Winchester Hard Disc. Giving you 8mb of storage and CP/M software that works across all the proven business packages.

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INDUSTRY-STANDARD 16-BIT BUSINESS SOFTWARE.

The new PULSAR business software is 16-bit software specially developed for new generation 16-bit personal computers.

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PULSAR is primarily written in the PASCAL portable language. So your investment in software is protected, regardless of how often you change your system.

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PULSAR has been developed by ACT's own software engineers as a true 16-bit system. And ACT has more than 15 years experience in business software – computer bureaux using ACT programs produce more than 3 million statements every year and handle business applications for more than 2000 companies. PULSAR incorporates many facilities that were previously available only on large mainframe computers.

INTEGRATION

ACT supplies integrated business software, linking every aspect of business accounting. Now with PULSAR, this integration is taken a stage further with word processing and business management tools able to share information and files with accounting applications.

USER-FRIENDLY

PULSAR is really easy to use. Documentation is to the highest standards in the industry, taking the operator step by step through the system. A simple question and answer routine on the computer screen prompts the user at every turn.

TOTAL SUPPORT

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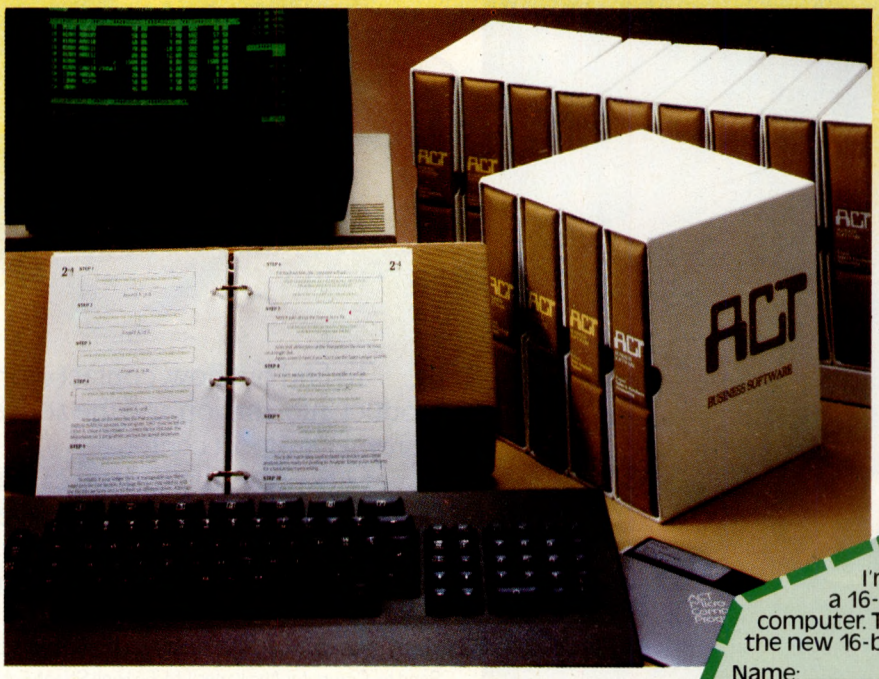

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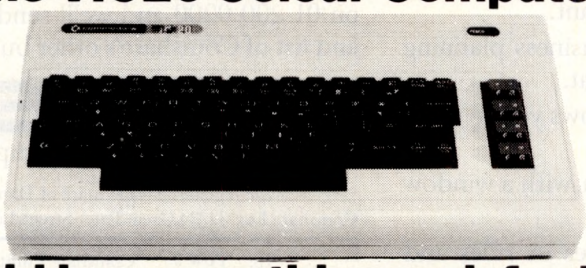

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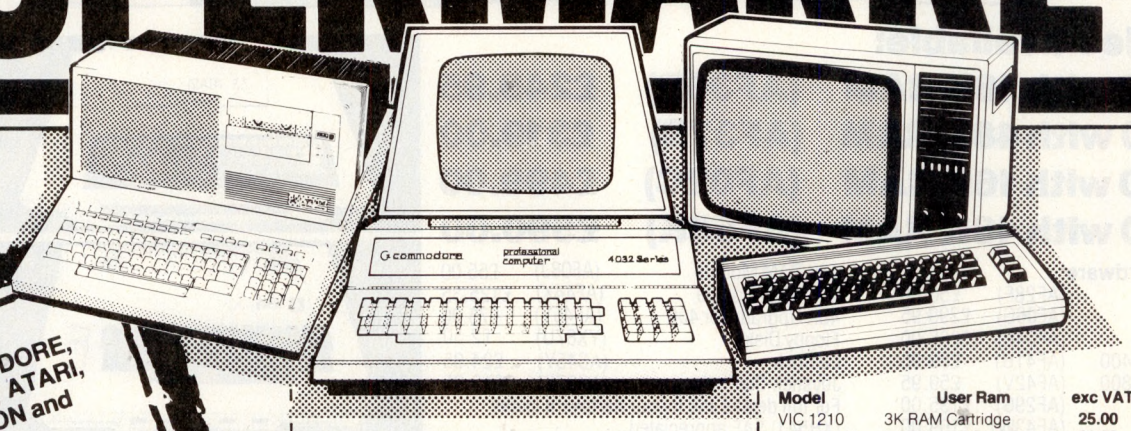

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GREEN INV. VIDEO
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YELLOW
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GRAPHICS
BLACK DELETE
1 ! DEF FN
2 @ FN
3 # LINE
4 $ OPEN #
5 % CLOSE #
6 & MOVE
7 ' ERASE
8 (POINT
9) CAT
0 _ FORMAT
SIN COS TAN INT RND STR$ CHR$ CODE PEEK TAB
Q PLOT ASN
W DRAW ACS
E REM ATN
R RUN VERIFY
T RAND MERGE
Y AND RETURN [
U OR IF]
I AT INPUT IN
O ; POKE OUT
P " PRINT ©
READ RESTORE DATA SGN ABS SQR VAL LEN USR
A STOP NEW ~
S NOT SAVE |
D STEP DIM \
F TO FOR {
G THEN GOTO }
H ↑ GOSUB CIRCLE
J − LOAD VAL $
K + LIST SCREEN $
L = LET ATTR
ENTER
LN EXP LPRINT LLIST BIN IN KEY$ PI
CAPS SHIFT
Z : COPY BEEP
X £ CLEAR INK
C ? CONT PAPER
V / CLS FLASH
B * BORDER BRIGHT
N , NEXT OVER
M . PAUSE INVERSE
SYMBOL SHIFT
BREAK SPACE

Sinclair ZX Spectr

16K or 48K RAM... full-size moving-key keyboard... colour and sound... high-resolution graphics...

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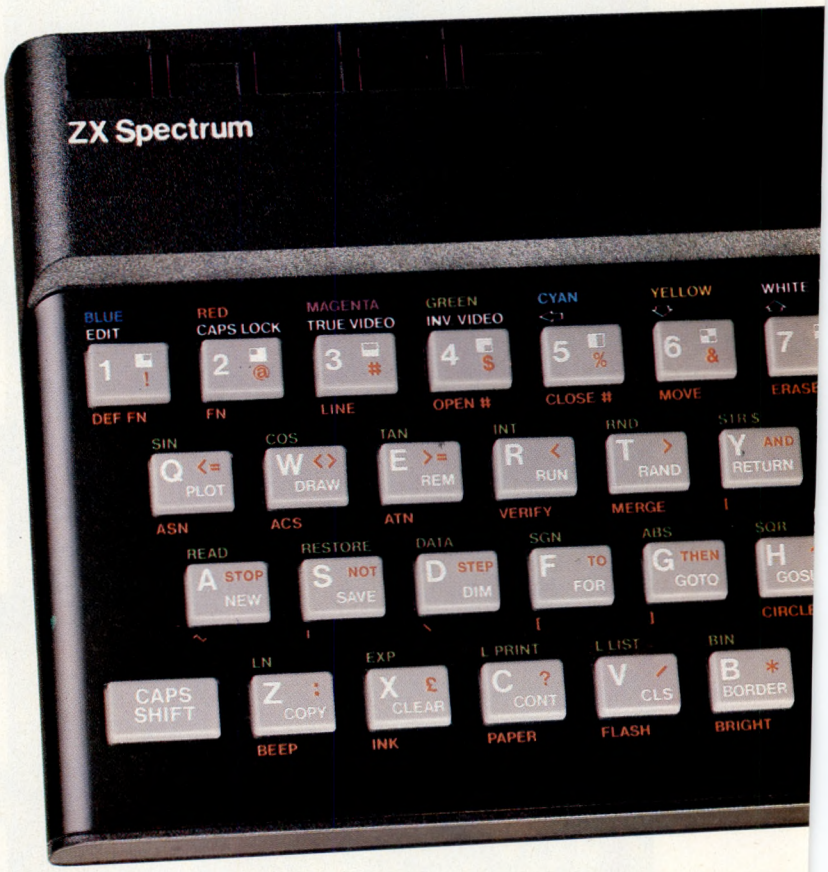


First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

Professional power– personal computer price!

The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can uprate later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

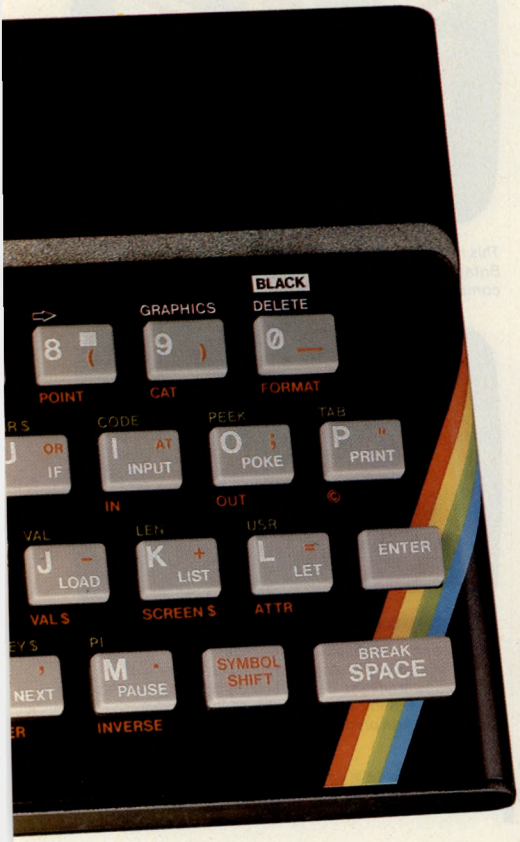
Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

There's no need to stop there. The ZX Printer – available now – is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.

Key features of the Sinclair ZX Spectrum

- Full colour – 8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound – BEEP command with variable pitch and duration.
- Massive RAM – 16K or 48K.
- Full-size moving-key keyboard – all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution – 256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set – with upper- and lower-case characters.
- Teletext-compatible – user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE – 16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC – incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

um



The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.

The ZX Microdrive – coming soon

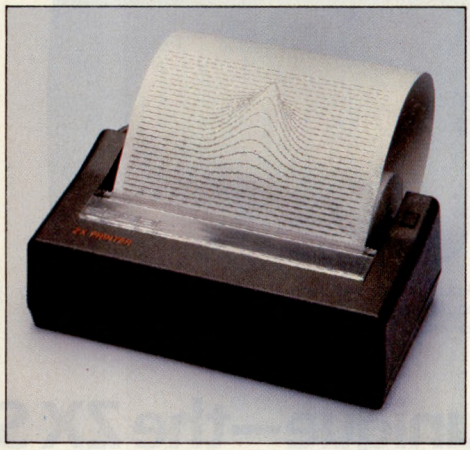
The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing.

Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microfloppy.

The transfer rate is 16K bytes per second, with average access time of 3.5 seconds. And you'll be able to connect up to 8 ZX Microdrives to your ZX Spectrum.

All the BASIC commands required for the Microdrives are included on the Spectrum.

A remarkable breakthrough at a remarkable price. The Microdrives are available later this year, for around £50.



RS232/network interface board

This interface, available later this year, will enable you to connect your ZX Spectrum to a whole host of printers, terminals and other computers.

The potential is enormous. And the astonishingly low price of only £20 is possible only because the operating systems are already designed into the ROM.

ZX Spectrum

Available only by mail order and only from

sinclair

Sinclair Research Ltd,
Stanhope Road, Camberley,
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How to order your ZX Spectrum

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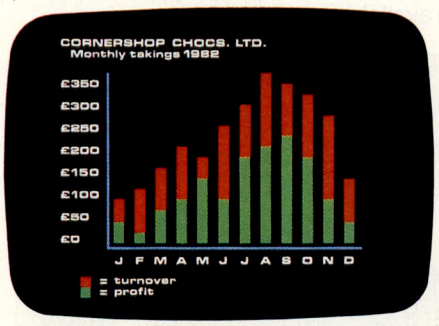
ZX Spectrum software: how good and how soon?

The ZX Spectrum uses an enhanced version of Sinclair BASIC, fast becoming a world standard, and unlikely to be superseded. Unique features, such as one-touch keyword entry and syntax check and report, are increasingly attracting software originators.

Building the software library is already far advanced, and a complete catalogue will be available in the next few months. Subjects will include sophisticated games, education, 'housekeeping', and business management. The more complex packages can, of course, be used to their best advantage with the full 48K RAM version of the ZX Spectrum.

The Sinclair ZX Spectrum can handle sophisticated games programs with high-resolution colour graphics and sound.

This major advance in computer technology maintains Britain's world-beating position in the field of personal computers.



A range of business software will soon be available, covering both specific applications (eg stock-control and payroll) and general business management systems (eg matrix models).

This second generation of Sinclair personal computers demonstrates continuing commitment. Advanced technology made the ZX80/81 family a price breakthrough: advanced technology makes the ZX Spectrum a breakthrough in price and performance.

Elegant, effective, unique—the ZX Spectrum design.

'Less than half the price of its nearest competitor – and more powerful.'

'These two pictures show how it's done. On the right is the PCB from the BBC Model A Microcomputer. On the left is the PCB from the ZX Spectrum.

'It's obvious at a glance that the design of the Spectrum is more elegant. What may not be so obvious is that it also provides more power.

'The ZX Spectrum has more usable RAM, and higher maximum RAM.

'It offers twice as many colours on the screen at any one time, plus a colour brightness control. It also offers user-definable graphics.

'It has data transfer rate 25% faster, supported by a VERIFY facility.

'And it employs a dialect of BASIC (Sinclair BASIC) already in use in over 500,000 computers worldwide.

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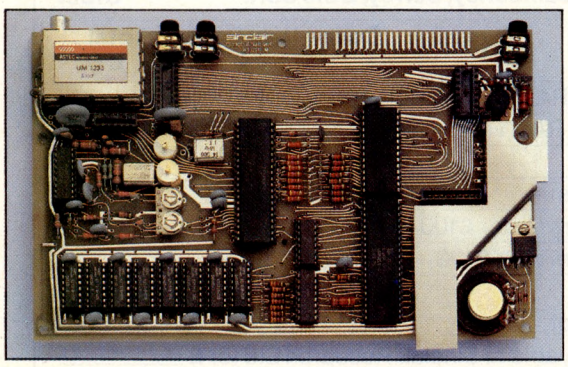
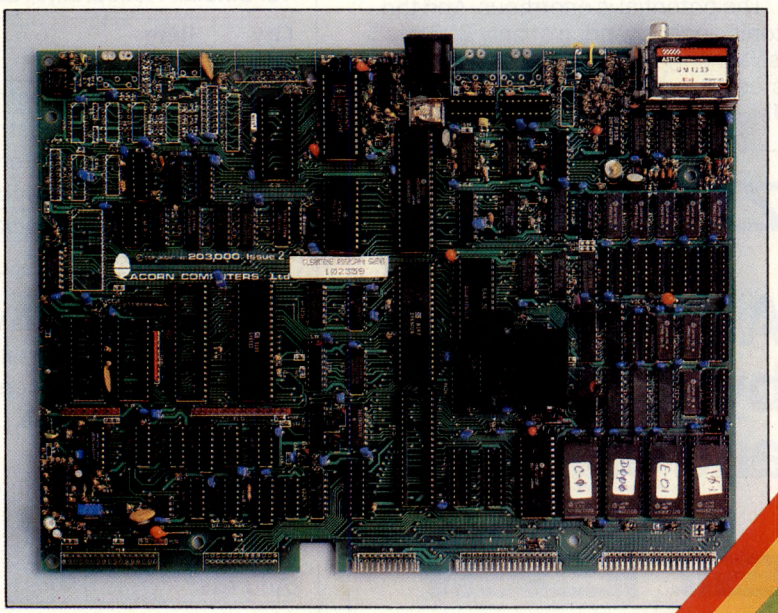
– Clive Sinclair.





Above left: internal layout of Sinclair ZX Spectrum.

Right: Internal layout of BBC Micro Model A.

The illustrations are to the same scale, and demonstrate the rate of advance in microcomputer design. The ZX Spectrum uses just 14 chips to provide more power and more user-available RAM.

sinclair ZX Spectrum

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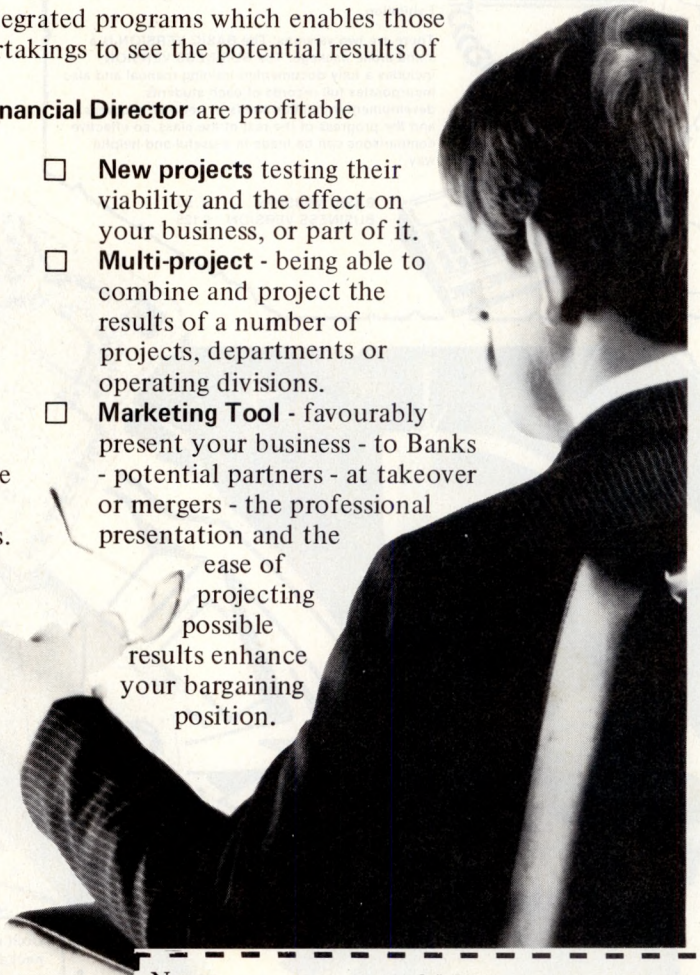

This software program runs on the Commodore Business Micro Computer. A typical complete system which includes software costs less than £4,000.

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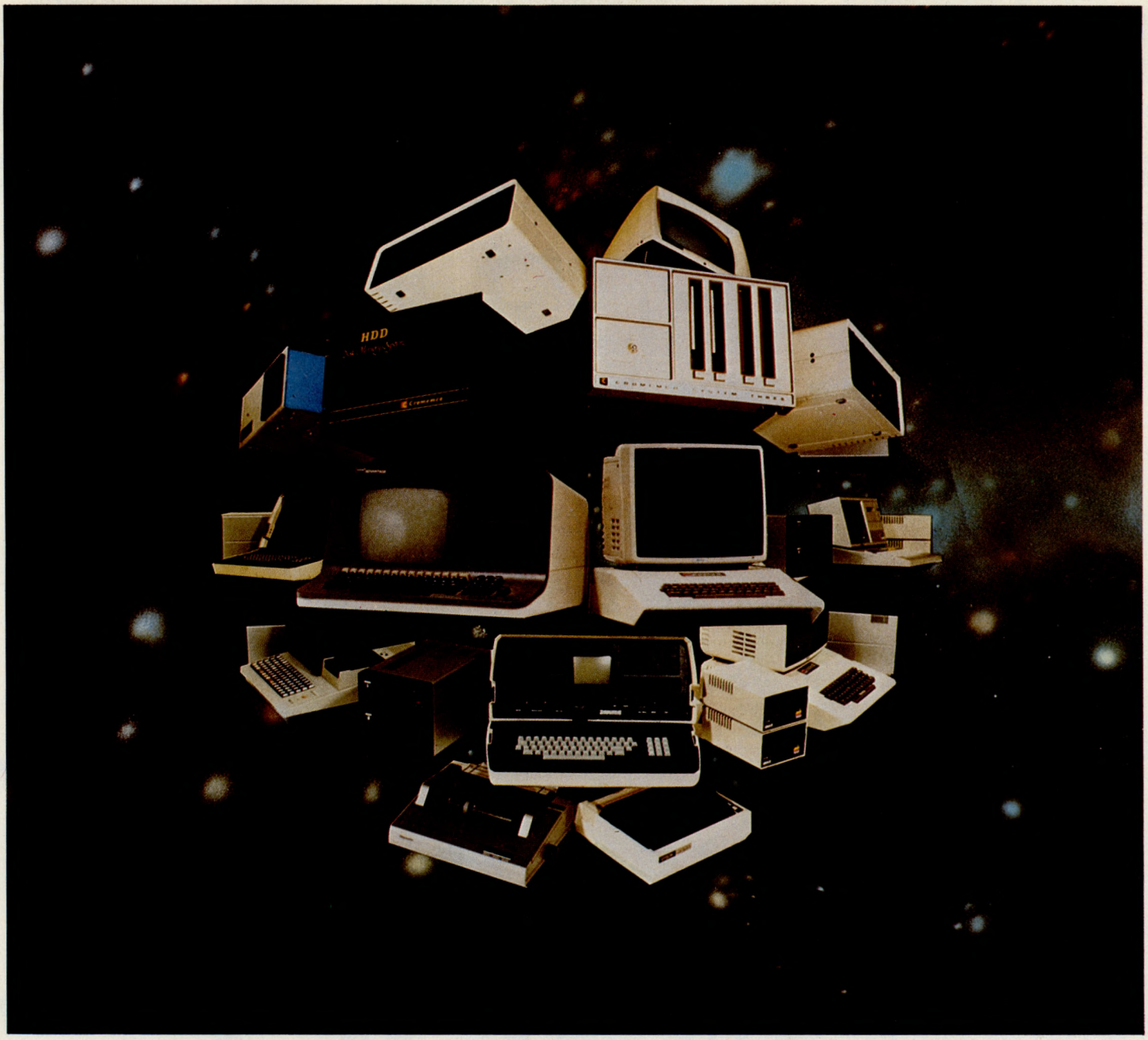

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Xitan Systems, the South Coast's leading centre for microcomputer hardware and software, offer a choice of over twenty systems from seven major manufacturers.

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NorthStar The Advantage desktop computer with business graphics.

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Xitan's services include system development, hardware and software support, and fast and effective service in the field.

Don't let its size fool you.

If anything NewBrain is like the Tardis.

It may look small on the outside, but inside there's an awful lot going on.

It's got the kind of features you'd expect from one of the really big business micros, but at a price of under £200 excluding VAT it won't give you any sleepless nights.

However, let the facts speak for themselves.

You get what you don't pay for.

NewBrain comes with 24K ROM and 32K RAM, most competitors expect you to make do with 16K RAM.

What's more you can expand all the way up to 2 Mbytes, a figure that wouldn't look out of place on a machine costing ten times as much.

We've also given you the choice of 256, 320, 512 and 640 x 250 screen resolution, whereas most only offer a maximum of 256 x 192.

Big enough for your business.

Although NewBrain is as easy as ABC to use (and child's-play to learn to use) this doesn't mean it's a toy.

Far from it.

It comes with ENHANCED ANSI BASIC, which should give you plenty to get your teeth into.

And it'll also take CP/M® so it speaks the same language as all the big business micros, and feels perfectly at home with their software.

NO OTHER MICRO HAS THIS MUCH POWER IN THIS MUCH SIZE FOR THIS MUCH MONEY.

So as a business machine it really comes into its own.

The video allows 40 or 80 characters per line with 25 or 30 lines per page, giving a very professional 2000 or 2400 characters display in all on TV and/or monitor. And the keyboard is full-sized so even if you're all fingers and thumbs you'll still be able to get to grips with NewBrain's excellent editing capabilities.

When it comes to business graphics, things couldn't be easier. With software capabilities that can handle graphs, charts and computer drawings you'll soon be up to things that used to be strictly for the big league.

Answers a growing need.

Although NewBrain, with its optional onboard display, is a truly portable micro, that doesn't stop it becoming the basis of a very powerful system.

The Store Expansion Modules come in packages containing 64K, 128K, 256K or 512K of RAM. So, hook up four of the 512K modules to your machine and you've got 2 Mbytes to play with. Another feature that'll come as a surprise are the two onboard V24 interfaces.

With the aid of the multiple V24 module this allows you to run up to 32 machines at once, all on the same peripherals, saving you a fortune on extras.

The range of peripherals on offer include dot matrix and daisy wheel printers, 9", 12" and 24" monitors plus 5¼" floppy disk drives (100 Kbytes and 1 Mbyte) and 5¼" Winchester drive (6-18 Mbytes).

As we said, this isn't a toy.

It doesn't stop here.

Here are a couple of extras that deserve a special mention.

The first, the Battery Module, means you won't be tied to a 13 amp socket. And, even more importantly, it means you don't have to worry about mains fluctuations wreaking havoc with your programs.

The ROM buffer module gives you a freedom of another sort.

Freedom to expand in a big way. It gives you additional ROM slots, for system software upgrades such as the Z80 Assembler and COMAL, 2 additional V24 ports, analogue ports and parallel ports.

From now on the sky's the limit.

Software that's hard to beat.

A lot of features you'd expect to find on software are actually built into NewBrain so you don't need to worry about screen editing, maths, BASIC and graphics.

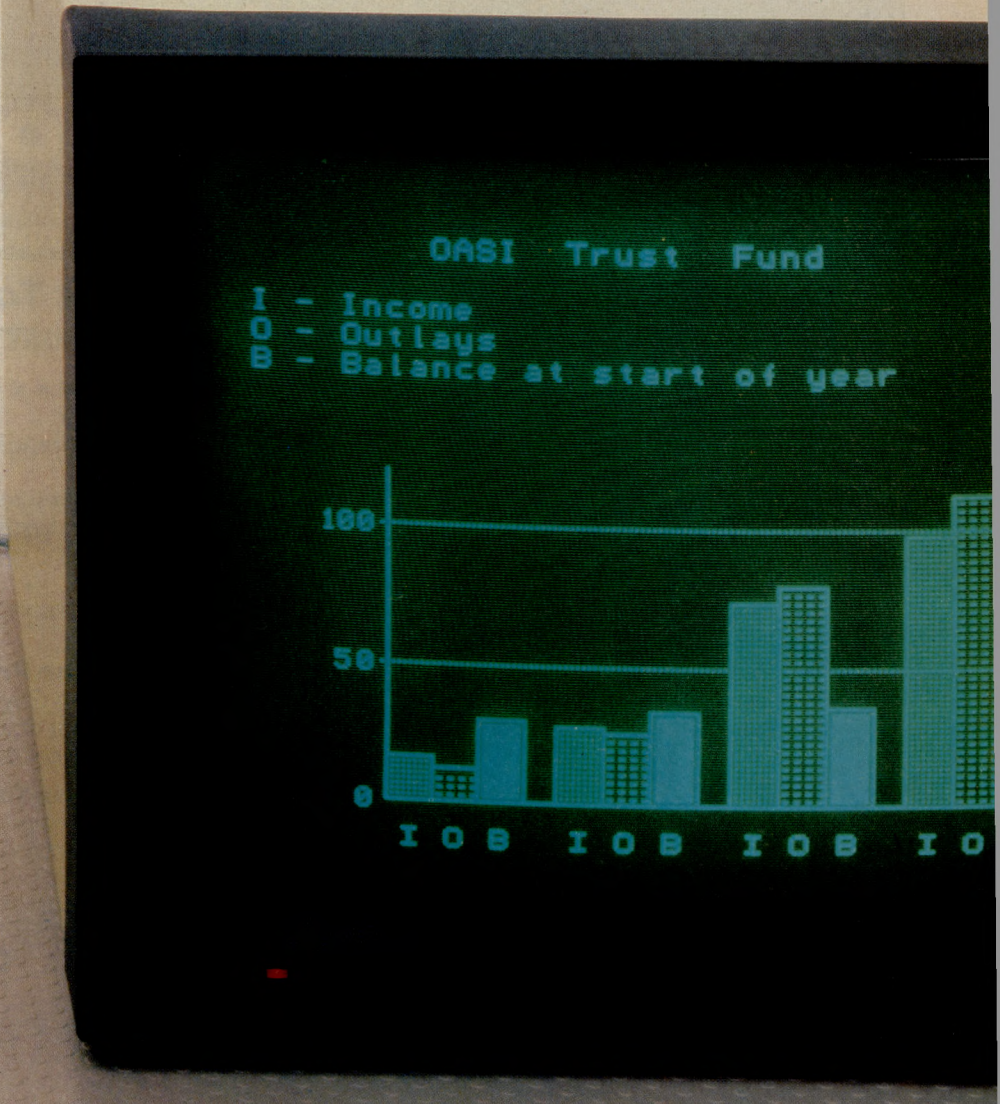
However, if you're feeling practical you can always tackle household management, statistics and educational packages. And because NewBrain isn't all work and no play, there's the usual range of mind-bending games to while away spare time.

Waste no more time.

To get hold of NewBrain you need go no further than the coupon at the bottom of the page.

With your order we'll include a hefty instruction manual so you'll know where to start, and a list of peripherals, expansion modules, and software so you'll know where to go next.

® CP/M is the registered trade mark of Digital Research Inc.



Dealer enquiries invited, please contact:–
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Each NewBrain order will include a FREE comprehensive user manual, a catalogue of expansion modules and peripherals, and a detailed list of available software.

Please send me the following:–

Quantity	Item	Price per item (Inc. VAT & p&p)	Total
	NewBrain A	£233.00	
	NewBrain AD with onboard single line display	£267.50	
	Printer	£466.00	
	Monitor 12"	£142.50	
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NewBrain, Grundy Business Systems Ltd., Grundy House, Somerset Road, Teddington TW11 8TD.

Please debit my Access Card No:_____ my Barclaycard No:_____

Signature_____

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NEWBRAIN

"If you can buy a business computer package of the same quality at a lower price, I'll buy it for you!"

Noel C. May, Managing Director
Transtec Computers.

The Transtec Total Accounting Package costs just £2400 (ex. VAT) and includes . . .

The BC2 Computer

- ★ 800K usable disk storage
- ★ 64K of memory
- ★ 80X25 hi-res. green screen
- ★ CPM 2.2 operating system as standard
- ★ Detachable keyboard with 17 function keys and numeric pad
- ★ In-built facility to expand capacity at any time.

The Printer
An Olivetti DM 5050C heavy duty 80 cols. 100 CPS dot matrix printer with capacity to handle single sheet or continuous sprocket fed paper.

The Software
Complete "Business Desk" set of programs by Paxton incorporating Invoicing, Stock, Sales, Purchase and Nominal Ledgers – a fully integrated accounting software package.

Other financial modelling, word processing and data base packages available at low all-in costs.

To get the full facts
Contact your local computer dealer or Transtec direct.

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Tel. (0272) 277462
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IDA Complex, Macken St., Dublin 2.
USA – Leading Edge Products Inc.,
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transtec

SIMPLY BETTER COMPUTING

INFORMATION TECHNOLOGY

EOS on-line

"What ever is best, wherever it comes from, EOS will try to have it first for the UK." That's the philosophy of Russell Sparkes, Marketing Director of EOS – who turned theory into fact when EOS became the first Distributor to offer UK end users the IBM Personal in quantity.

"The business we are in moves at lightning speed. Every end user knows exactly what is available in various parts of the world . . . and he wants to get his hands on it today – not at some vague date in the future. My job is to make sure that end users in the UK are not left behind."

Two years ago, Russell Sparkes and his co–director Tony Maclaren moved from a routine office supply business into tomorrow's world of computers. As Dealers in the City of London, they saw how end–users were starved of the latest equipment. In February this year, they made their first buying visit to North America – and in June, signed a contract to bring enough IBM Personals into the UK to meet the immediate demand for this,

"End users want tomorrow's technology in their offices today . . . EOS aims to get it there."

the world's most up to date micro–computer available.

July 22nd saw the first EOS National Dealer Conference. It was held at The Barbican and attracted more than a hundred would be EOS Dealers and software suppliers.

Within two weeks, more than fifty Dealers nationwide had been accepted into the EOS Dealership Network.

"We look for Dealers with a proven track record and attitudes that show they thoroughly understand the needs of todays businessman. We provide our Dealers with tomorrow's equipment today. We select only the best

"Excellent products . . . first class dealers . . . nationwide back–up . . . that's what EOS is all about."

equipment – and only the most active Dealers."

Sparkes aims to expand his Dealership Network to approximately 100 within the next few months. "We must make sure that every end user in the country has at least an opportunity to test the IBM Personal or any of the other advanced systems we are carrying."

Russell Sparkes, Marketing Director of EOS.

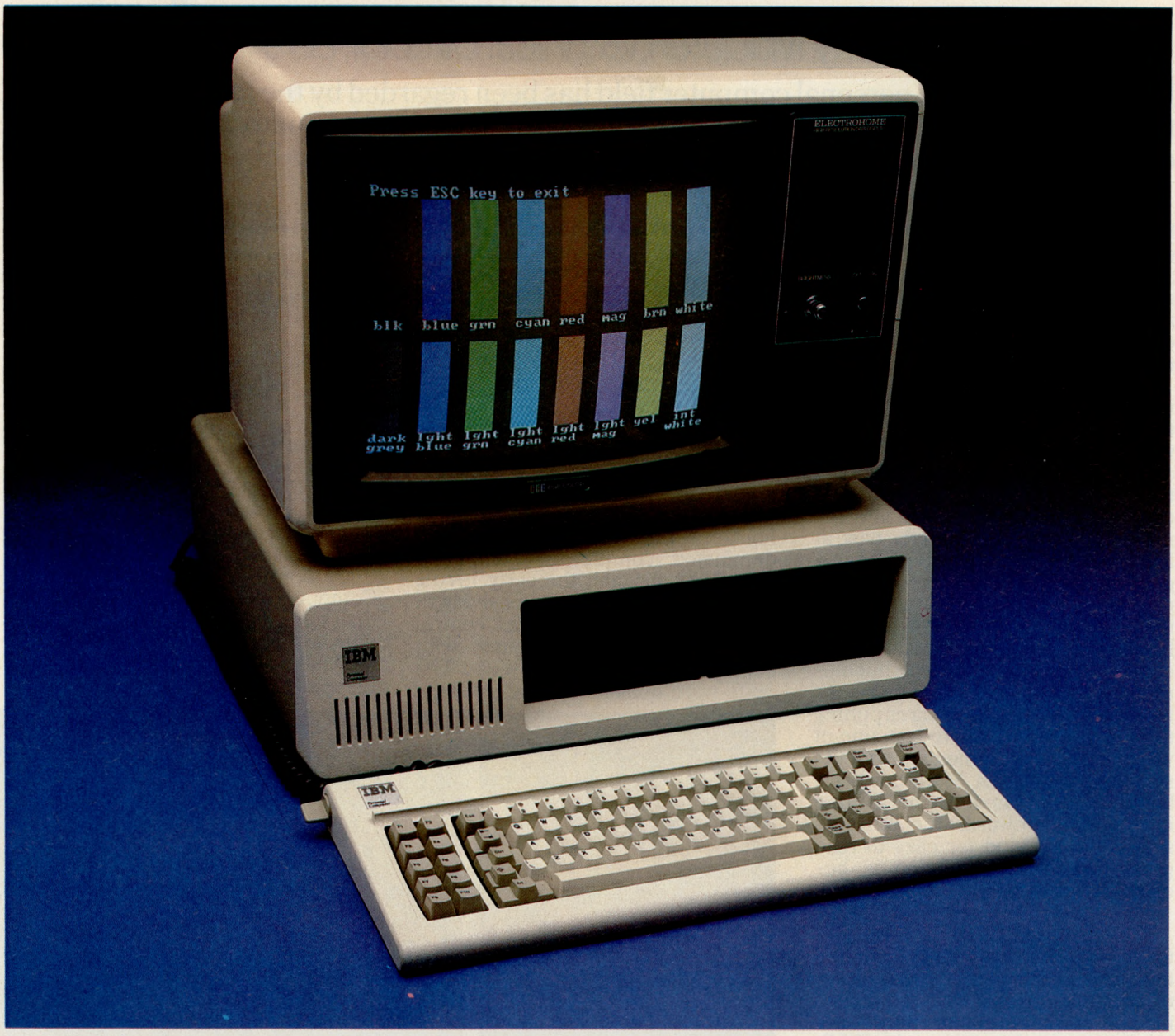
In tandem with their Dealership strategy, EOS have chosen General Computer Systems to provide nation–wide 24 hours a day servicing and maintenance cover. "In our opinion" says EOS Technical Director Tony Maclaren, GCS offer the best back–up facility available today. They are quick, reliable and up to the second with their knowledge of technology. Added to that, they understand the pressures of todays commerce . . . so they get the job done."

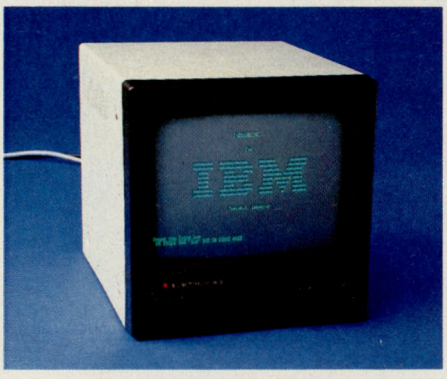
The EOS Portfolio of hard and software is impressive. Much of it – for example the EOS 7000 three–in–one printer and the newly contracted TIM 111 – is exclusive to EOS.

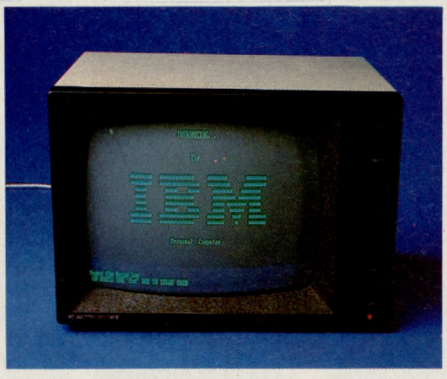
"All our equipment was on display at the PCW Show at the Barbican" says Russell Sparkes, "but we wanted to give PCW readers who couldn't get along to the Barbican in early September an opportunity to see something of our product range. In the following pages we have illustrated some of the lines we are offering through our Dealership Network to end users throughout the length and breadth of the country. It is a carefully integrated package of personal computers, memory boards and software . . . an ever changing Portfolio. We are constantly striving to provide the best, the most reliable and the most up to date.

That's our Company policy. That's the way we intend to continue. Tomorrow's technology today – that's what EOS is really all about."

Electrohome Colour Monitors







EOS has recently concluded negotiations with Electrohome Limited in Canada to supply their two models of colour monitors with RGB inputs specifically designed for use with personal computers. These are in fact data monitors and are ideal for using with either Apple III or the IBM Personal Computer. There are two models of monitor: the ECM 1302 provides resolution of 370 by 235 pixels and has a 13″ screen. With a band width of 6 megahertz it can display 40 characters by 25 lines. The ECM 1302/2 displays 580 by 235 pixels, has a 13″ screen and with a 10 megahertz band width can display 80 characters by 25 lines. These monitors provide a very sharp display with vivid colours and no screen distortion. Neatly styled, the new Electrohome colour monitor has an attractive moulded cabinet and its buff colour ensures that it matches attractively with personal computers such as the IBM and the Apple III. Special leads are supplied to our customers to connect directly to the personal computer of your choice without the need to get involved with awkward wiring problems.

The small business computer

By Tony Maclaren, Technical Director, EOS

IBM's entry into the personal computer field has been regarded by the industry as one of the most significant developments in the short history of micro computers. To witness the entry of the IBM into the micro computer market place is to witness history being made.

The IBM Personal Computers will have considerable business significance for a whole spectrum of existing and future users of small business computers. The IBM PC is a true 16 bit machine using an Intel 88 microprocessor, offering over twice the memory of traditional 8 bit machines.

I think today, as things are becoming increasingly more complicated in the world of small computers, a buyer will increasingly "buy a company" with all of its reputation, intent and practices. This tendency is part of the excitement about IBM's entry into the market. Buying an IBM in the past, at least for certain products, has been a good investment for many business people. The personal computer industry, like all growing industries, has suffered growing pains. It has come out of an historical hobbies market and one of its chief problems has been the tendency towards putting the low priority items to last, one of which has been documentation for the systems themselves. As the market is becoming more mature and shifting its emphasis towards the business sector, the demand for easy to read professional documentation is becoming increasingly more important.

Attention to detail.

The fact that IBM's profit before taxes for 1980 was nearly 6 billion dollars – greater than the gross sales of many companies that are recognised as corporate giants – may be in a large measure the reason why IBM's system documentation and tremendous attention to detail is so good in everything connected with the IBM Personal Computer. To the business man the ability to be able to immediately put his new purchase to work for him is extremely important. Time wasted struggling through badly indexed photocopied manuals is simply unacceptable for the modern business professional.

One of the most unusual departures on the point of IBM has been that they have departed from their traditional posture of manufacturing their own components for computers themselves. In the case of the personal computer, IBM went to Tandon for the disk drives, Epson for the printer, Intel for the micro computer chip, Microsoft for the operating system, Information Unlimited Software for the word processing package and Visicorp for the Visicalc package. This, I feel, to some extent shows how increasingly important it is becoming for standardisation in such things as operating systems and fundamental small computer software packages such as Visicalc. Even the giant IBM has adopted the posture of standardisation which is going to be the key to the survival of all future companies in this highly competitive industry.

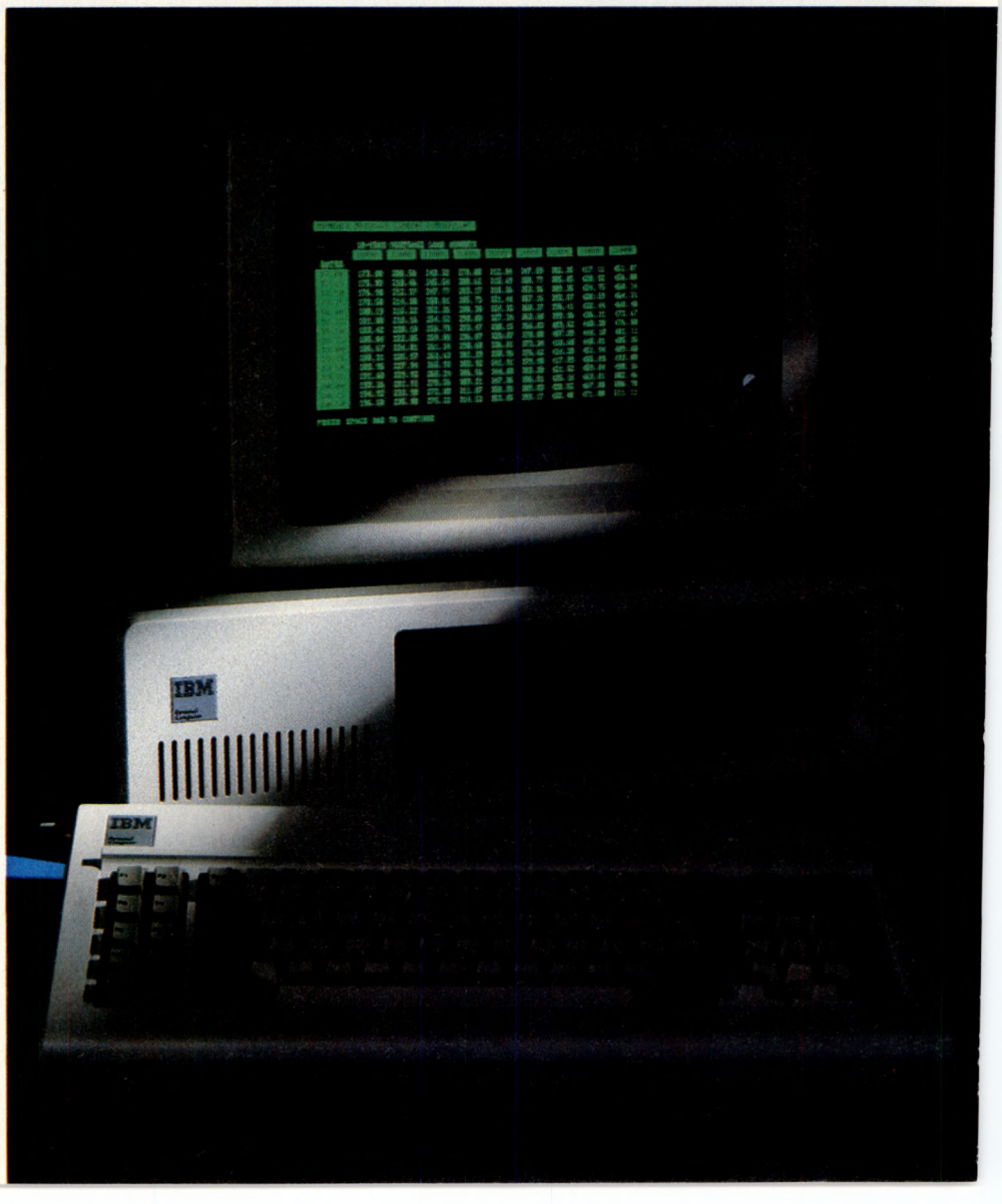
Power

The IBM Personal Computer is now so powerful that in some extents it surpasses the capabilities of main frame computers only a decade ago. For example, the IBM 360 which dominated commercial computing from 1964 through the early 1970's. The 360/40 was used extensively in payroll accounting and stock control applications for companies with several thousand employees. The 360's were housed in huge environmentally controlled rooms, cost $180,000 for only the 32K model plus $168 per month maintenance. These machines had a maximum memory of only 262K of RAM compared to 760K on the IBM Personal Computer. The cost of a 262K 360/40 was $497,000 plus $383 per month maintenance. The Personal Computer sells for £2,950.

Speed

As for speed, the CPU of the 360 could access main storage in approximately 2.5 micro seconds compared to the Personal Computer's total storage access and retrieval time of only 600 nanno seconds.

Floppy disk drives for the Personal Computer are up to 200 times faster than the early card readers and punches used on the early 360's. For both pure speed and memory size, the Personal Computer can match one of



by the biggest in the business

the most popular and most powerful main-frames of only ten years ago. This is not to say that the Personal Computer's total work capacity is as great as the 360. Actual output is dependent on the speed, number and capacity of peripheral devices such as line printers, hard disks etc. However, even this area has now been challenged by personal computing with the advent of low cost Winchester disk drive technology both increasing in power and decreasing in cost. It seems that no area is safe from the inroads of technology.

Local work station

In large businesses where there are large amounts of experience with large main-frame computers, the IBM will be used as a local work station for everyday business use in addition to its use as a terminal to the main-frame computer. Even by comparison with very recent 8 bit micro computers, the IBM has made really significant break-throughs in the type of business tasks it can handle. When combined with electronic spread sheet packages such as Supercalc, models of up to 500K can be accommodated and using IBM's colour graphics adaptor and a high resolution RGB monitor such as the Electrohome, it is possible to construct extremely large financial models and get a very high degree of feedback from the system through the clever use of colour display.

Although there is now a small number of 16 bit personal computers coming into the market place, it seems that IBM have given considerable thought to where the next step will come in terms of speed and power requirements. Micro processors can perform thousands of mathematical instructions per second but micro processors work with only one or two bytes at a time. This limitation restricts the speed at which they can add floating point numbers. Mini computers and main-frames also suffer from this problem. However, they invariably have what is called a floating point processor or a math processor to deal independently with calculating floating point arithmetic. IBM have left an auxiliary socket next to the main processor in their Personal Computer for an Intel 8087 floating point processor to be installed. This will represent a very significant technical advance over even current 16 bit micro computers in that as the tendency becomes more and more for these machines to be used for accounting and business applications, they will be in need for faster arithmetic. For a few hundred pounds an 8087 can be installed which will drastically increase the performance of electronic spread sheets, such as Supercalc, and give a vital performance improvement in many accounting packages, etc., written in high level languages such as BASIC and PASCAL.

Colour Graphics

Winchester disk drives of the 5¼" size are now so small that they can be fitted inside the IBM PC and this, combined with compiled programs, will give a further increase in speed, performance and capacity. With the colour graphics adaptor IBM have taken an extremely flexible approach. The colour graphics adaptor board can be used not only with a high resolution colour monitor but also with a colour television receiver with a RF modulator and a standard monochrome monitor. The colour graphics adaptor has the same graphics characters as the display printer adaptor but offers two additional capabilities: coloured characters and individually addressable dots on the video screen (graphics). This board is extremely flexible in that, when used with a colour monitor, it can be used in black and white character mode for packages such as word processing and electronic spread sheets. With the new Supercalc package it can also, of course, be used in colour.

16 colours are possible which are variations on the three primary colours (red, green and blue) and the actual intensity can also be varied. In colour graphics mode 320 dots horizontally by 200 dots vertically is possible. In the high resolution mode-640 by 200.

The IBM is supplied with three operating systems: PC DOS which by any other name is MS DOS by Microsoft, CPM 86 from Digital Research and UCSD/P system from the University of California and San Diego. The IBM is supplied with two basics, standard Microsoft basic and an advanced basic which takes in the special commands for use with IBM's colour graphics adaptor, some of which are extremely useful when creating attractive colour displays. Some of these unique statements are circle, draw, get, paint, put. Under the MS DOS operating system, there are several extremely useful compilers available from Microsoft. These are BASIC, FORTRAN, COBOL AND PASCAL, all of which are two pass compilers producing full machine code. In the short space of time that EOS have been dealing with the IBM Personal Computer, we have seen a really staggering amount of progress in the amount of software available for the machine. New software packages are received in our offices for evaluation at the rate of about two a week.

Great memories run in our family

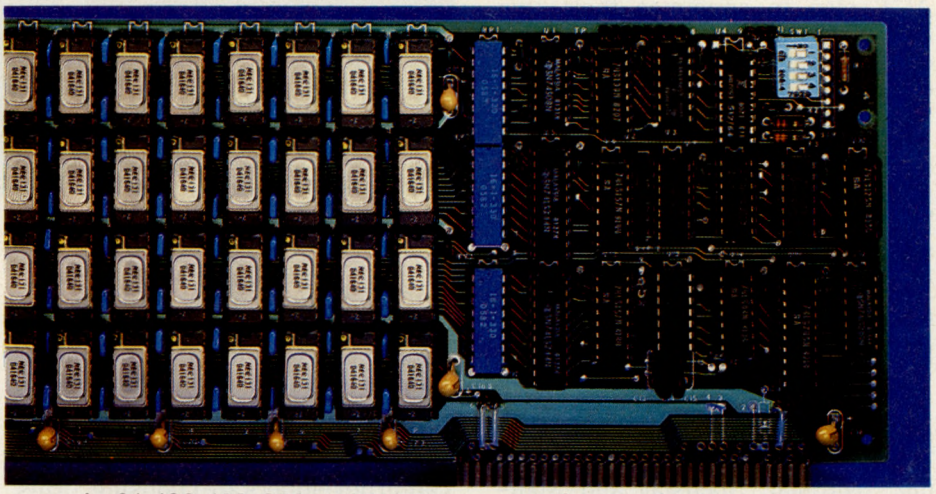
Now EOS offers you and your IBM powerful memory-expansion PCBs with up to 512Kb storage per board.

With these versatile add-ons, you can increase your computer's memory to the highest, practical level of current technology – and do it with minimal demands on space and power.

Because only the finest-quality materials and construction go into our multi-layer boards, you are assured of both the lowest signal distortion and the best RFI performance.

Mapping ROM makes set-up fast and easy, with a choice of flexible memory configurations.

Our five PCB memories are available



now – in 64, 128, 192, 256 and 512Kb. Each can be obtained in an expandable version.

Whatever your needs may be, you'll find that our "product-family" approach to memory design and manufacture backs you with total operating-system support – before and after sale.

For complete details on our family's great memories, don't forget to return our coupon.

Sirius–Britain's best selling 16 bit

The Sirius I is the UK's *best selling 16 bit* personal computer. It is based on the Intel high speed *8088 microprocessor.* The Sirius supports a *large range of advanced 16 bit software* to take advantage of its unique capabilities.

Beautifully designed

...the screen tilts and swivels to suit the user and screen glare is eliminated through the use of a special coating. The quality of the display is superb with the ability to display 800 x 400 pixels. Contrast and brightness can be adjusted from the keyboard without the need to reach behind the monitor as was necessary on earlier micros. The best high resolution graphics in the business.

Massive memory!

Because the Sirius can address directly up to 896K bytes of RAM, plenty of capacity is available for professional business software – the machine is an ideal "data base machine" – EOS offers complete data base solutions from a "user friendly electronic file cabinet" (TIM III) to a full fledged data base management system (MDBS III).

Larger floppy disks.

Sirius is available as standard with 2 600K disk drives or 2 x 1.2 megabyte drives are available as an option. More than any other comparable personal computer! 5 and 10 megabyte internal Winchester disk drives will be available shortly (probably at PCW). Local area networking is available now from outside suppliers, and ACT plan to announce their own system shortly – more than enough expansion potential as business needs change and develop in the future.

Sirius speaks.

Sirius offers a revolutionary feature "voice synthesis" using a small microphone messages can be "dictated" to your Sirius, which then stores the message in RAM or on disk for subsequent incorporation into your programs or relayed to another Sirius in another office – or using RS232C coms – anywhere.

Fabulous software.

Sirius provides a complete range of business software, ACT's PULSAR, TABS, SYSTEMATICS for accounting. Wordstar, Spellstar and Mailmerge for word processing. Supercalc, Multiplan and Micromodeller. There is also SELECT, the only word processor that teaches you how to use it in less than 90 minutes. More than 100 top software companies are developing specialist software for every business and profession.

More languages.

The Sirius supports all the new MICROSOFT compilers, BASIC, PASCAL, FORTRAN and COBOL. UCSD PASCAL has also recently been introduced. We have found that this wide variety of *BUSINESS* languages is why more and more application developers are choosing Sirius.

Two operating systems as standard.

The Sirius is supplied with two 16 bit operating systems as standard – MS DOS and CP/M 86 with CONCURRENT CP/M 86, the multi-tasking version, on the way.

Communications.

Sirius two RS232C ports as standard – both are fully programmable up to 19200 band. Facilities are also available to communicate with large mainframe computers.

Peripherals.

EOS can connect the Sirius to almost anything – printers, plotters, digitisers, modems etc. Combined with the EOS 7000 it can dump all the screen graphics out onto the printer. With Supercalc the EOS 7000 can print 272 columns at near letter quality.

Hello TIM, goodbye filing cabinets

With the exception of spread sheets and financial modelling packages, the area that will undergo the most extensive and rapid development on personal computers will be information management systems. These are also commonly referred to as "data base" packages.

The problem in the past has been that these packages were not "user friendly."

One of the most significant products to appear in this field is TIM III from INNOVATIVE SOFTWARE INC.

The non-programming approach.

TIM III is a state of the art data base management program, it is written in compiled basic – so it is quick, and because it supports hard disks, it can handle large data bases. Most important of all, TIM III is extremely easy to use. TIM communicates with you on your own terms by using a fully menu driven approach. Just pick what you want from the lists of displayed options. *No programming required.* Help is always available throughout the program, and a clear, well indexed and easy to understand Users Manual is included.

These features combine to make TIM user productive almost immediately after using the program.

Word processing interface.

TIM interfaces with Wordstar and Select in both directions, ie TIM files can be put into Wordstar and Wordstar files can be put into TIM.

A proven system.

Over 3,000 TIM III programs have been sold on the IBM Personal. TIM is currently available under MS DOS for the Sirius and IBM Personal Computers and all CP/M 2.2 machines.

Electronic Office Services is the sole distributor for TIM III in the UK.

Exclusive to EOS, the 7000 3-in-1 Printer is capable of operating in three different modes – fast mode at 180 cps, letter quality at 90 cps and high definition graphics at 120 dots per inch. The EOS 7000 is available now at the new low price of £1,995.

CAUSE AND EFFECT

Every day, a new–and frequently unexpected–factor will affect your business...oil, the dollar, the value of sterling, the price of sugar–or copper...whatever your business, something (or someone) will create a situation that calls for a complete recast of targets, budgets and cash flow. Until now, that has meant a lengthy, often labour intensive rethink.

The new version of Supercalc for the IBM Personal Computer represents the latest state of the art of technology in electronic spread sheets, offering up to 512K main memory capability. The largest financial models can be accommodated. The superb colour capability brings a new dimension to electronic spread sheets. Being in the 'red' really does take on a new meaning . . . if a new figure entered into a cash flow produces a negative cash balance, all these figures appear in red.

One of the new features is the ability to protect fields so that items which are important are not accidentally erased. Using protective fields enables the author of the spread sheet in question to lay out a mask into which an operator who has no detailed knowledge of the model may input figures for later manipulation.

One of the most useful facilities is the ability to define variable column widths. This enables one to have, for example, a wide column A for inserting titles for the rows, a number of columns for the months of a cash flow at, let us say, 9 characters and a total column of say 13 characters, allowing complete flexibility. Where the package scores over more well–known products such as Visicalc is the excellent context specific help messages provided.

If the user is unsure when prompted by a selection of mnemonics by the system, he simply types a question mark and immediately receives a more detailed description of the options indicated by the mnemonics. It is also possible to load all or part of a particular work sheet and to output the spread sheet to a disk file which can later be incorporated into a word processing package.

Editing is simplicity itself and it is possible to simply call up a particular entry and insert, delete or modify your entry with a few simple key strokes. Another excellent feature is the ability to insert dotted lines or indeed repeating characters of any type right across the page without the need to replicate cells as was necessary with earlier spread sheet programs.

Tell Supercalc today's price of copper, or how the dollar shifted overnight. It will do the rest for you and keep you totally up to date at the touch of a key.

WANTED: Top class dealers to join the EOS network

An EOS Dealer has access to tomorrow's technology today. He will be offering his clients the most comprehensive, modern and reliable range of hard and software, much of it exclusive to him through EOS. He can guarantee service and maintenance of the highest order and be assured of full support in terms of advertising and publicity, brochures, posters and mailings. He will also have his own clearly defined geographical territory.

If you wish to be considered for an EOS Dealership, contact:
Russell Sparkes,
Marketing Director,
EOS House,
29–31 Fleet Lane,
London EC4M 4YA.
Telephone: 01–248 6971.

On the previous pages, we have been able to show some of the products from the EOS portfolio of hard and software for today's business applications.

If you would like further information about any of the products shown, please tick the appropriate box(es), and post the coupon to:

EOS, PCW Enquiry, EOS House, 29–31 Fleet Lane, London EC4M 4YA.

Your enquiry will be forwarded to your nearest EOS Dealer.

☐ Electrohome Colour Monitors ☐ IBM Personal ☐ EOS 7000

☐ EOS Memory Boards ☐ ACT Sirius 1 ☐ TIM III ☐ Supercalc

NAME _____

COMPANY _____

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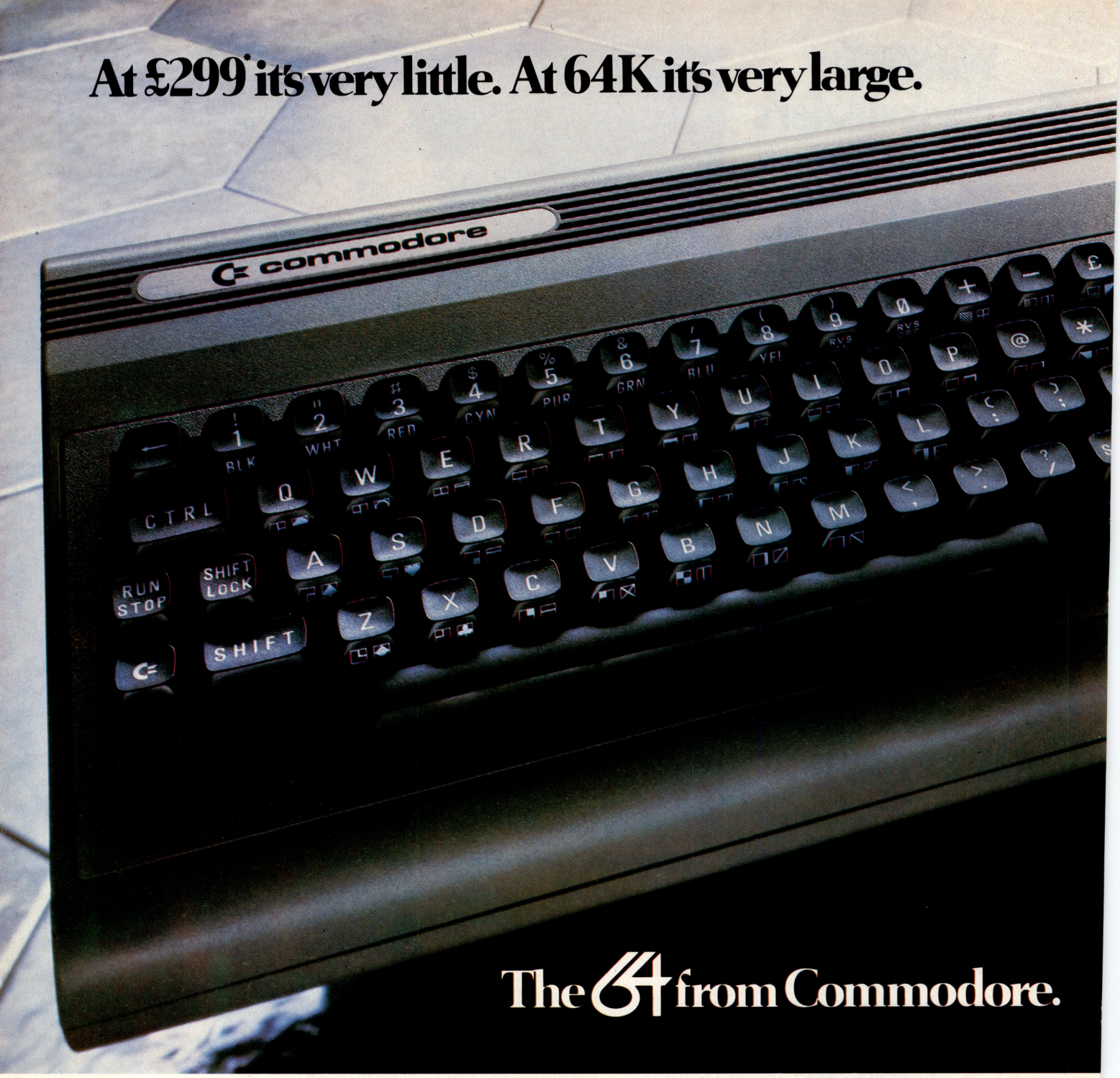
TELEPHONE _____

PCW10

At £299* it's very little. At 64K it's very large.



This is the new Commodore 64 Personal Computer.

It costs £299. Not bad for a brilliant piece of technology with a 64K memory.

But then, it's a Commodore.

And as one of the world's leading high-performance micro-computer companies, we're not exactly unknown when it comes to outstanding achievements.

The Commodore 64's nearest rival – if that's the word – costs over half as much again.

Here is the specification, a comparison with the Apple II, and a coupon.

The rest is up to you.

---

1. A total memory capacity of 64K; 38K directly available to BASIC. When not using BASIC a full 54K is available for machine code programs.

2. Interface adaptors will allow the use of a complete range of hardware peripherals including disk units, plotter, dot matrix and daisy wheel printers, Prestel communications, networking and much, much more.

3. A complete range of business software including word processing, information handling, financial modelling, accounting and many more specific application packages will be available.

4. Other computer languages such as LOGO, UCSD PASCAL, COMAL and ASSEMBLER are being developed. Existing VIC and 40 column PET BASIC programs can be easily converted.

5. The powerful sound chip gives 3 totally independent voices each with a range of 9 octaves. User control over music envelope, pitch and pulse shapes provides the ability to make your Commodore 64 sound like a variety of musical instruments, solo or in harmony.

6. 62 predefined graphic characters plus

full alpha numerics with upper and lower case letters, all available directly from the keyboard and displayable in normal or reverse video in any of 16 colours.

7. 40 column by 25 lines colour display. In high resolution graphics mode, a bit mapped screen gives 320 x 200 individually addressable pixels.

8. The dedicated video chip allows the use of high resolution multi-coloured "Sprites" (moveable object blocks). Sprites can be moved pixel by pixel, independently of anything else on the screen.

9. Sprites can also be set up in 8 "layers" giving full 3 dimensional effects with, if required, automatic collision detection between sprites and any other screen object.

10. Machine bus port will accept ROM cartridges for many applications, including business, educational, home and leisure software.

11. A second processor option using the Z80 gives the Commodore 64 the ability to support CP/M®.

HOW COMMODORE PIPS APPLE.

FEATURES	COMMODORE	APPLE II+
Base Price	£299*	£499*
ADVANCED FEATURES		
Built-in user memory	64K	48K
Programmable	YES	YES
Real typewriter keyboard	YES (66 keys)	YES (52 keys)
Graphics characters (from keyboard)	YES	NO
Upper & lower case letters	YES	NO**
Function keys	YES	NO
Maximum 5¼" floppy disk capacity per drive	170 K.B. to 1 M.B.	143 K.B.
AUDIO FEATURES		
Sound Generator	YES	YES
Music Synthesizer	YES	NO
Hi-Fi Output	YES	NO
VIDEO OUTPUT		
Monitor Output	YES	YES
T.V. Output	YES	EXTRA
INPUT/OUTPUT FEATURES		
Cassette Port	YES	YES
Intelligent Peripherals	YES	YES
Serial Peripheral Bus	YES	NO
ADDITIONAL SOFTWARE FEATURES		
CP/M® Option (over 1000 packages)	YES	YES
External ROM cartridge slot	YES	NO

*EXC. VAT – DETAILS CORRECT AT TIME OF GOING TO PRESS
**UPPER ONLY
CP/M® IS A REGISTERED TRADEMARK OF DIGITAL RESEARCH, INC.

commodore

For more information on the powerful new Commodore 64, and the address of your nearest Commodore dealer, telephone or write to us at:
The Commodore Information Centre,
675 Ajax Avenue, Slough, Berkshire SL1 4BG.
Telephone: Slough (0753) 79292.

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POSITION

COMPANY

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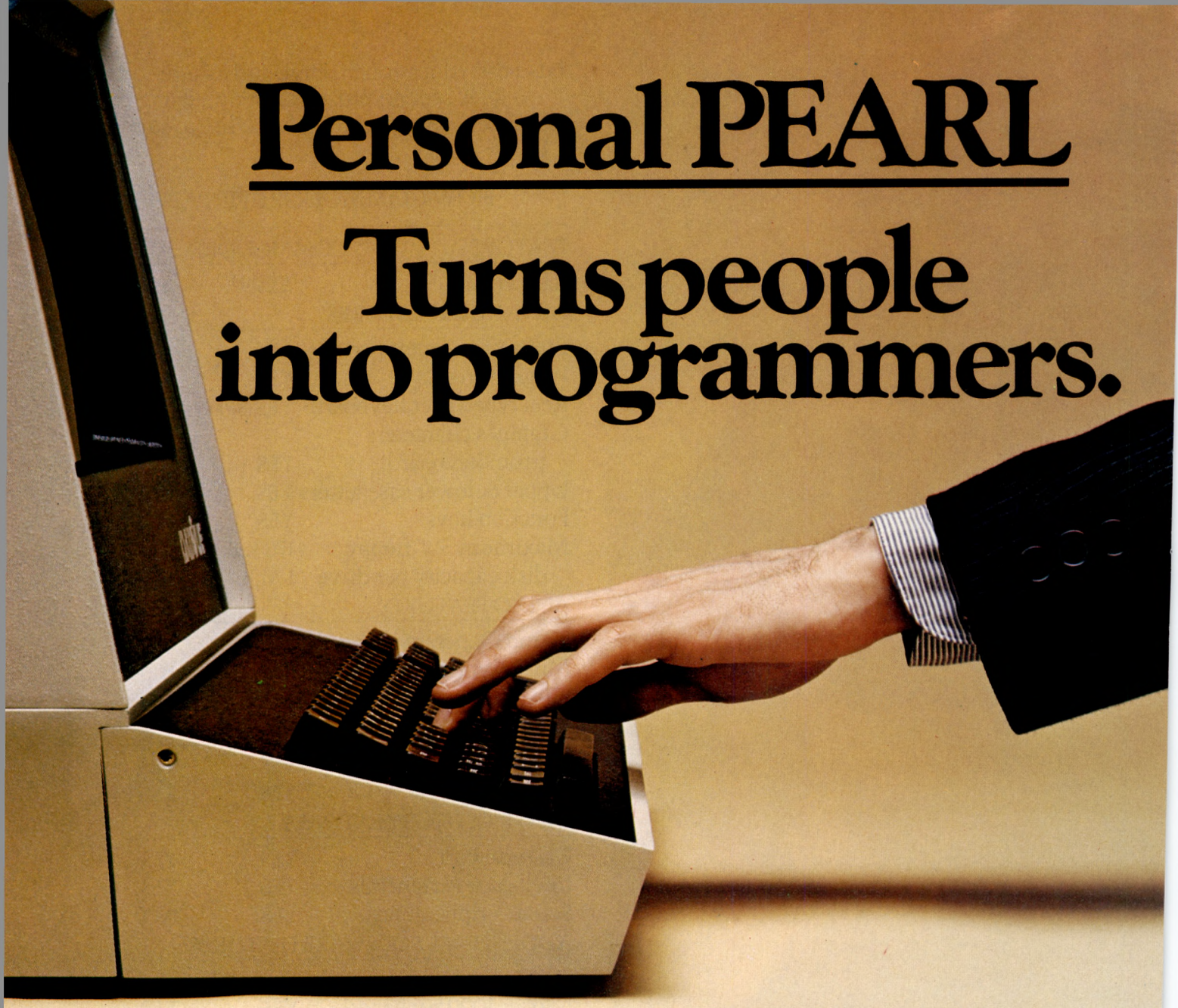
TEL

Personal PEARL

Turns people into programmers.



If you could program a computer by simply telling it the result you wanted, without using complex codes or languages, then anyone could become a programming professional. Sounds fantastic?

But now it's possible with Personal PEARL, and all for less than £200. It generates quality Business Programmes, Data Management, Costing, Mailing – in fact you create your own library of programmes that matches your operation today, and tomorrow.

After all, no-one understands your business better than you. So let Personal PEARL take the technology out of computer programming, and you'll find yourself writing professional business software – at the touch of a button.

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Pearl Software International (UK) Limited, PO Box 34, Poole, Dorset, BH14 8AR.
Tel: Parkstone (0202) 741275

Please send more details of Personal PEARL.

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Address:_____

_____ Tel:_____

Computer Make:_____

Disk Size:_____ VDU Make:_____

Pearl Software International (UK) Limited,
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Tel: Parkstone (0202) 741275

PERSONAL PEARL

PURPOSE

To provide a natural, easy way for people to create custom application programs through an English language interaction with a personal computer.

DESCRIPTION

Personal Pearl is the natural, human way to create new computer solutions. Computers are designed to solve general problems at incredible speeds. Application programs are required to operate the computer in order to quickly solve specific human problems. Personal Pearl unlocks the power of the computer so you can resolve your unique business problems.

Personal Pearl asks you for examples of the results you require from the computer. Personal Pearl then produces the application program. Personal Pearl is for the individual who requires custom computer solutions without the cost and time delay of hiring a programmer.

With Personal Pearl, you can create a library of personal programs, each tailored to your individual requirements. Accounting, mailing lists, data files, data management, calculations and reporting. Personal Pearl builds the program library of your choice, for one price.

Why buy several programs designed for the average computer use? Buy Personal Pearl to create an entire library of the highest quality programs designed by you, for your Personal Pearl leads you through the program design. Your answers are used by Personal Pearl to create the new program.

HIGHLIGHTS

- Interactive English program development. Menu-oriented application description speeds development via formated screens, input error checking.
- Built in HELP facility.
- Display handling is defined by using Personal Pearl's convenient full-screen facilities to simply type in the display screens exactly the way they are to appear in the new program.
- Report handling is defined in the same way; by simply formatting the display screen to show the layout of the reports required by the new program.
- The application program display screens or reports may be modified at any time, or new displays or reports may be added.
- Calculation edit: arithmetic operations, editing, translation, table look up, and data validation are included.
- Data routine: display-to-display, display-to-printer, and display-to-file facilities are provided.
- Files may be quickly and easily sorted, printed, searched for selected records, reorganised or analysed.
- Display screens, files or reports may be modified to reflect changing program requirements.
- Display screens may be custom designed in any form.
- Reports may be custom designed in any form. Several report formats may be stored for later use.
- Data may be sent to SuperCalc* or Multiplan* for forecasting.
- No limitation on number of application programs.
- Maximum file sizes determined only by the maximum capacity of the disk storage medium on the computer.
- Records may be up to several thousand characters long, if needed.
- The number of records that may be stored in a file is determined by the total file size. Records are variable length with record packing, eliminating the wasted space incurred by fixed length schemes.
- Data base support is provided by an independent data base manager.
- File support is provided through indexing and sequential data access.
- Security and Integrity of Data:
  - Data input can be validated against previously defined edit criteria before changes are made to data files.
  - Edit criteria can be modified dynamically.
- Automatic Screen Entry Message:
  - Users of Personal Pearl can establish messages to the program operator in order to direct correct data entry.
- Data File Independence:
  - The descriptions of data files are maintained in an independent description file – the dictionary.
- Multiple Program Integration
  - Several generic programs such as word processing and spread sheet analysis may be integrated through Personal Pearl.

PREREQUISITE PRODUCTS
CP/M Operating System
48K RAM Microcomputer

PEARL software

Manufacture, OEM and dealer enquiries welcome.
Suggested retail price: under £200* *excluding VAT

To: PEARL INTERNATIONAL (UK) LTD, PO BOX 34, POOLE, DORSET, BH14 8AR
Please send me details of Personal Pearl

Name ..... Firm .....

Address .....

..... Postcode .....

Type of equipment ..... Disc size and format .....

Type of VDU .....

WIN THE EXCITING NEW GENERATION DRG VICTOR 9000*

MICRO COMPUTER

PLUS 1 YEAR ON-SITE MAINTENANCE.
PLUS TABS SOFTWARE TO SUIT APPLICATION.
PLUS FULL TRAINING.
PLUS A TEC LETTER QUALITY PRINTER.

TOTAL VALUE £5000

*VICTOR 9000 and SIRIUS are manufactured by the same company.

More power on the DRG VICTOR 9000

The DRG Victor 9000 is a new generation 16 bit micro with the power to rival many minicomputers.

Designed to meet the need for more powerful business applications, its 1.2 MB of floppy disk is expandable to 2.4 MB of floppy disk creating the flexibility to cope easily with longer customer files, company records and word processing.

How to qualify

Visit a one day free seminar where TABS software will be demonstrated on the DRG Victor 9000 **OR** Buy the new TABS paperback manual.

How to enter

Each entrant must complete a competition entry form. This will include answering simple questions about TABS on DRG Victor 9000 and writing no more than 300 words on why you need a microcomputer accounting system. Competition entry forms are available from any of the participating Accredited Dealers listed below or from TABS at any of the one day seminars also listed below.

Closing date for entries is December 31st. The winner will be announced in the Daily Telegraph by February 1st.

TABS FREE SEMINARS. LONDON Great Eastern Hotel 19 Oct. 20 Oct. 16 Nov. **NOTTINGHAM** George Hotel 6 Oct. 2 Nov. 30 Nov. **MANCHESTER** Grand Hotel 4 Oct. 4 Nov. **BIRMINGHAM** Crest Hotel 12 Oct. 9 Nov. **EDINBURGH** Caledonian Hotel 29 Sept. 27 Oct. 25 Nov. **NEWCASTLE** Holiday Inn 27 Sept. 26 Oct. 23 Nov. **CARDIFF** Park Hotel 14 Oct. 11 Nov. **BRISTOL** Unicorn Hotel 22 Sept. 18 Oct. **EXETER** Royal Clarence Hotel 8 Nov.

PARTICIPATING DEALERS: LONDON: Andrew & Co 01 402 6911; Data Management Systems 01 739 8692; Q. E. D. Computers 01 959 7403/8346. AVON: Colston Computer Centre Ltd 0272 276619. BERKSHIRE: Decision Support Systems Ltd 0628 76887; Thames Valley Systems 0734 581829. BUCKINGHAMSHIRE: Cardinal Computers Ltd 06284 73776/73074. CHESHIRE: Desktop Computing 0925 415415. DERBYSHIRE: FBC Systems Ltd 0332 365280. DEVONSHIRE: Keel Data Systems 054 884 3520. ESSEX: Humac Computer Services Ltd 0708 752005. GLOUCESTERSHIRE: Computer Shack 0242 584343. KENT: A.E.C. Business Systems 0732 864829; Page One Systems Ltd 0279 416808; The Data Processing Co Ltd 0303 41618. LANCASHIRE: Mipac Services 0524 62033. LINCOLNSHIRE: ZR (Computers) 0522 31621. MANCHESTER: Sumner Jackson & Co Ltd 061 832 8261. NOTTINGHAMSHIRE: Micro People Ltd 06076 69117. SOMERSET: Computer Sales & Marketing 06438 3526; The Computer Room 0935 73023. SURREY: Computron 01 943 1113; Interlex Ltd 01 943 0968; Micro-Engineering Ltd 01 397 8137. SUSSEX: Computaccount 08926 5765. TYNE & WEAR: Microcore 0632 846878; Quality Micro Products 0632 614646. WEST MIDLANDS: Beta Computer Services 0676 34664; Datacraft (Computer Systems) 021 705 1906; I.S.L. Ltd 0922 26282; P.J. New Computers Ltd 021 742 6801. WILTSHIRE: Fyne Computing 0722 20323; J.R.M. Software Ltd 02214 65691. WORCESTERSHIRE: Spinks Computer Systems Ltd 0905 29466. NORTHERN IRELAND: FACS 0662 47618. WALES: DYFED: Aberdata 09745 344. SOUTH GLAMORGAN: Data Plant 0222 40411.

For more information about TABS on the DRG Victor 9000 please 'phone Andover (0264) 58933 or write to TABS Ltd, Sopers House, Chantry Way, Andover, Hants SP10 1PE. or DRG Business Machines, 13/14 Lynx Crescent, Winterstoke Rd., Weston-super-Mare, Avon BS24 9DN.

Please send me _____ copy/ies of the new TABS paperback manual @ £10 per copy

Plus _____ competition entry forms (1 per manual).

I enclose cheque/postal order for £ _____

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Accounting Business Systems

TABS

THE GALAXY 1 COMPUTER

The cost effective solution to your computer needs for only £1,450*

The Galaxy 1 desk top computer system can be used in education, small business applications, word processing, stock control and a host of other environments. Our choice of CP/M as the operating system means that our customers can select a suitable application package from the widest possible range.

However, unlike our competitors, we supply not only the hardware but all the essential system software needed to start using the Galaxy 1 as soon as it is installed. We have adopted COMAL-80 as our standard language. This structured basic is rapidly gaining widespread acceptance and popularity especially in the education market, offering much greater flexibility and ease of use than existing Basics. We also supply a very powerful Z80 assembler/editor called GEM ZAP with GEM PEN, a compact but very powerful word processing package. The system software suite is completed with GEM DEBUG, a useful machine code program de-bugging utility.

Modular design means reliability and ease of maintenance. Unlike many other manufacturers Gemini offer a full one year warranty (except Disc heads which are guaranteed for 3 months). Our distributors carry a full range of replacement boards thereby facilitating a quick, efficient and cost effective back up customer service.

Features include:

- **Twin Z80 Processors**
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- **800 K Disc Based Storage**
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- **Dual Printer Interfaces**
- **Modular Design**
- **CP/M 2.2 Operating system**
- **COMAL-80 – Structured Basic**
- **Z80 Editor/Assembler**
- **Text Editor & Formatter**
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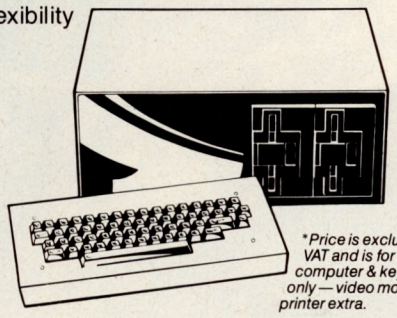

**Price is exclusive of VAT and is for computer & keyboard only — video monitor & printer extra.*

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Telephone Amersham 28321 for the name and address of your nearest distributor.
**** Dealer enquiries invited.***

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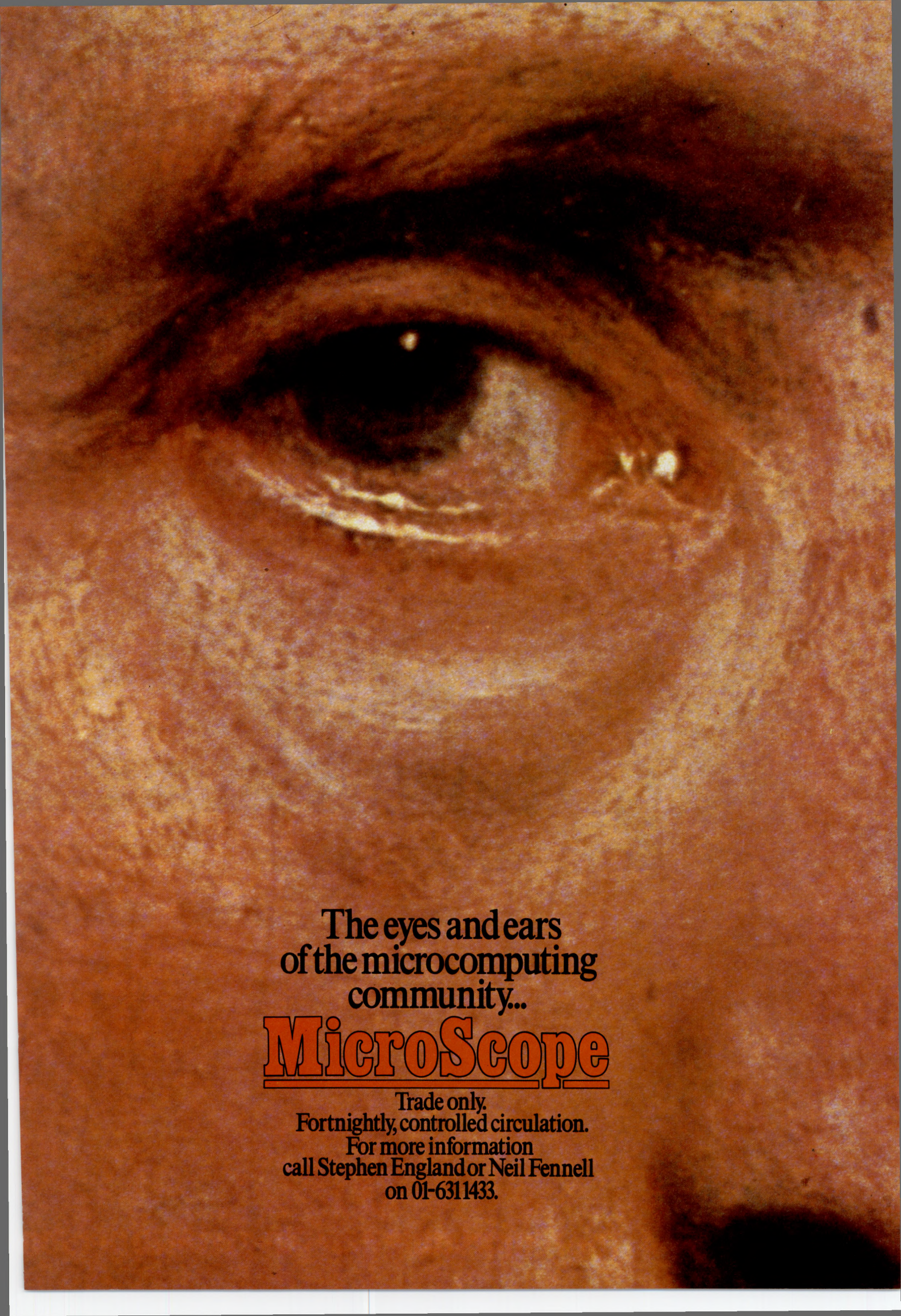
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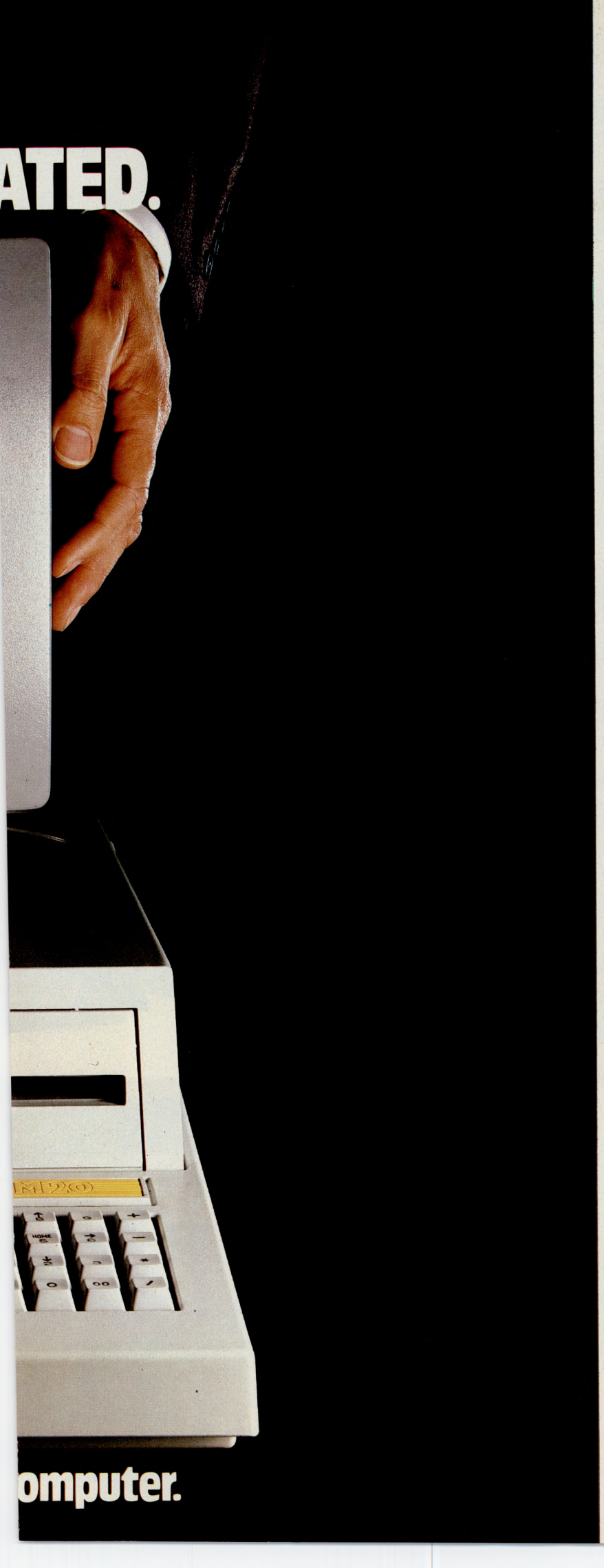
The remarkable new Olivetti M20 person



Please forgive our boasting but the new Olivetti M20 really does make the current crop of computers look like toys for adults.

It's simply the most advanced personal computer in Britain.

The 16-bit central processing unit and 'bus' allow larger more complex programs to be run on larger amounts of data and at far greater speed.

It has two 5¼" mini floppy disk units with a capacity of 320k bytes each that are integral to the system.

(These can be further extended with the addition of a hard disk.)

And it has a minimum internal capacity of 128K bytes.

The result is an extremely powerful computer with interfacing capabilities that allow it to communicate with a wide range of peripherals.

That's proof that it's brainy, but it's also beautiful.

The visual brilliance and clarity of the VDU can be controlled as its position can be swivelled and tilted to suit the operator.

And as well as handling up to two thousand characters, the screen can produce a variety of complex, high resolution graphics.

Naturally, lines, circles, ellipses, bar charts and pie charts are a cinch.

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It's all clever stuff but its language is simple.

It uses Microsoft®Basic which has been developed to a new level of professionalism.

In fact, the advanced PCOS*operating system combined with its programming language make the M20 easier to use than a typewriter.

But if you do manage to get lost there's a 'Help' function to guide you.

The M20 also has the reassuring ability to run through its circuits every morning and if any are faulty it'll tell you.

So Olivetti's national and international network of service engineers can work even faster.

Send off the coupon and find out why the M20 is simply brilliant.

And brilliantly simple.

*CP/M available.

For more information on the M20 Personal Computer please send this coupon to Valerie Belfer.

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OEM enquiries welcome.

olivetti

® Microsoft Basic is a registered trademark of Microsoft Inc.

£1,350*

The MIMI 802 is a supreme example of high quality British engineering. It is a truly professional microcomputer that really does meet all the criteria of a sophisticated business machine - at a price you can afford.

Our competitors expect you to make do with the basics and then buy expensive extras in order to fulfil your needs. The MIMI 802 has all the 'extras' as standard - so when you buy a MIMI you really are getting a microcomputer that will do the job from the outset.

The MIMI's operating system OS/M† is fully CP/M‡ compatible so you have access to a very comprehensive range of software, extending from word processing to accounting.

During the next few months we will be announcing the availability of TROJAN - a major software innovation that totally simplifies the learning process and use of micros. and dramatically eases the creation of new applications programs. We are using it and generating applications software in record time - so we can guarantee its performance.

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Features include:

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- 64K Dynamic RAM
- Integral D/S - D/D 5¼ ins floppy discs - 700Kb.
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And now with:

- Winchester disc option.
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NOW ALL OTHER MICROS ARE LESS THAN PERFECT

† OS M is the trademark of Scifax Microsoftware.
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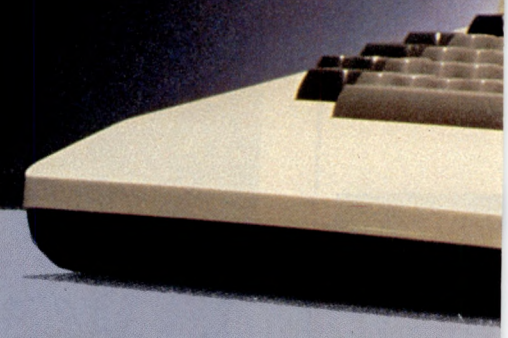

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The entire PC-8000 system is now available through better computer dealers across the country. And that means more than hardware. It means effective software, the finest documentation and extensive training to help you get the most from your personal computer. So why not turn our system to your personal advantage now.

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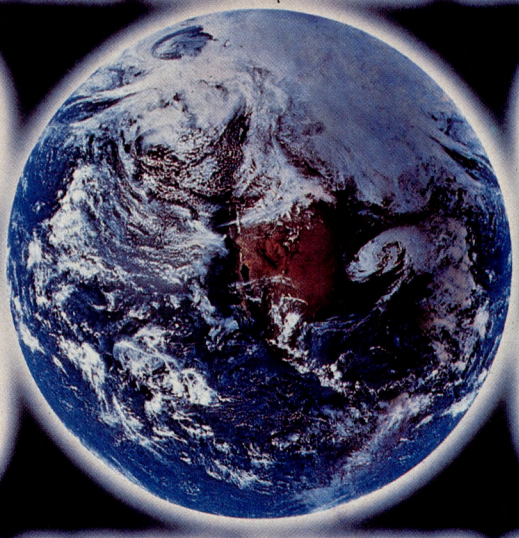

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Choose BOS, and you're choosing the most advanced business software for micro and mini computers available today.

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Remember, when you choose a computer, what you get out depends on the software you put in. So choose the best—choose BOS.

THE RIGHT SOFTWARE CHOICE

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The ICL Personal Computer with power to grow as you need it.

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The new ICL Personal Computer gives you more.

It's a versatile, professional personal computer. It can start with a single Visual Display Unit, naturally, and it has a wide range of functions to meet your increasing requirements. And it can grow larger than most other personal computer systems, because its capacity for additional hardware is greater.

Starting at £2,895 with one VDU

The ICL Personal Computer provides a range of options enabling you to have a system tailored to meet your changing needs.

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Wide range of integrated accounts and other application software available, providing limitless possibilities.

So your secretary can do her word processing, you can do your forecasts, your accountant can do the invoicing, and your programmer can do his own thing, all at the same time. Thats what makes ICL Personal Computer more than just a personal computer.

And because ICL is Europe's leading computer company, with thousands of satisfied users in over 80 countries worldwide, **we can offer ICL Trader Point service and maintenance back-up that's second to none.**

What more could you ask for, apart from a demonstration?

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Company Name & Address _____

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MODEL III HIGH RESOLUTION GRAPHICS

128 user definable characters which effectively give a resolution of 512 × 192.
No external wires or connections, everything is fitted within the case.
Graphic characters optionally software selectable.
Comes complete with demonstration and setup programmes on diskette and cassette.
Fully documented user manual.
Comprehensive fitting instructions (Kit only).

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KIT PRICE including PandP, VAT and insurance. **£129.95**.
Fully installed, tested and guaranteed. **£169.95**.
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The machine language plotting programme "SETXY" is included "FREE" for those people purchasing from this advert.

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If you purchase any Model III from us we will install the graphics for you at kit price.

THE MICROFIRM TURBO MIII

The TRS-80 Model III including:
48K RAM.
14k ROM.
64 × 16 VDU.
4 megahertz clock speed up.
Dual TEAC 80 track disc drives (737,280 bytes total).
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Fully insured, carriage and VAT included. **£2295.95**.
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Increase your Model III speed from 2.02 megahertz to 4 megahertz with the MICROFIRM 4 meg module.
Software switchable 2 or 4 meg.
Software switchable to 2 meg disk access for those without appropriate operating system (ie NEWDOS/LDOS).
Includes full fitting instructions.
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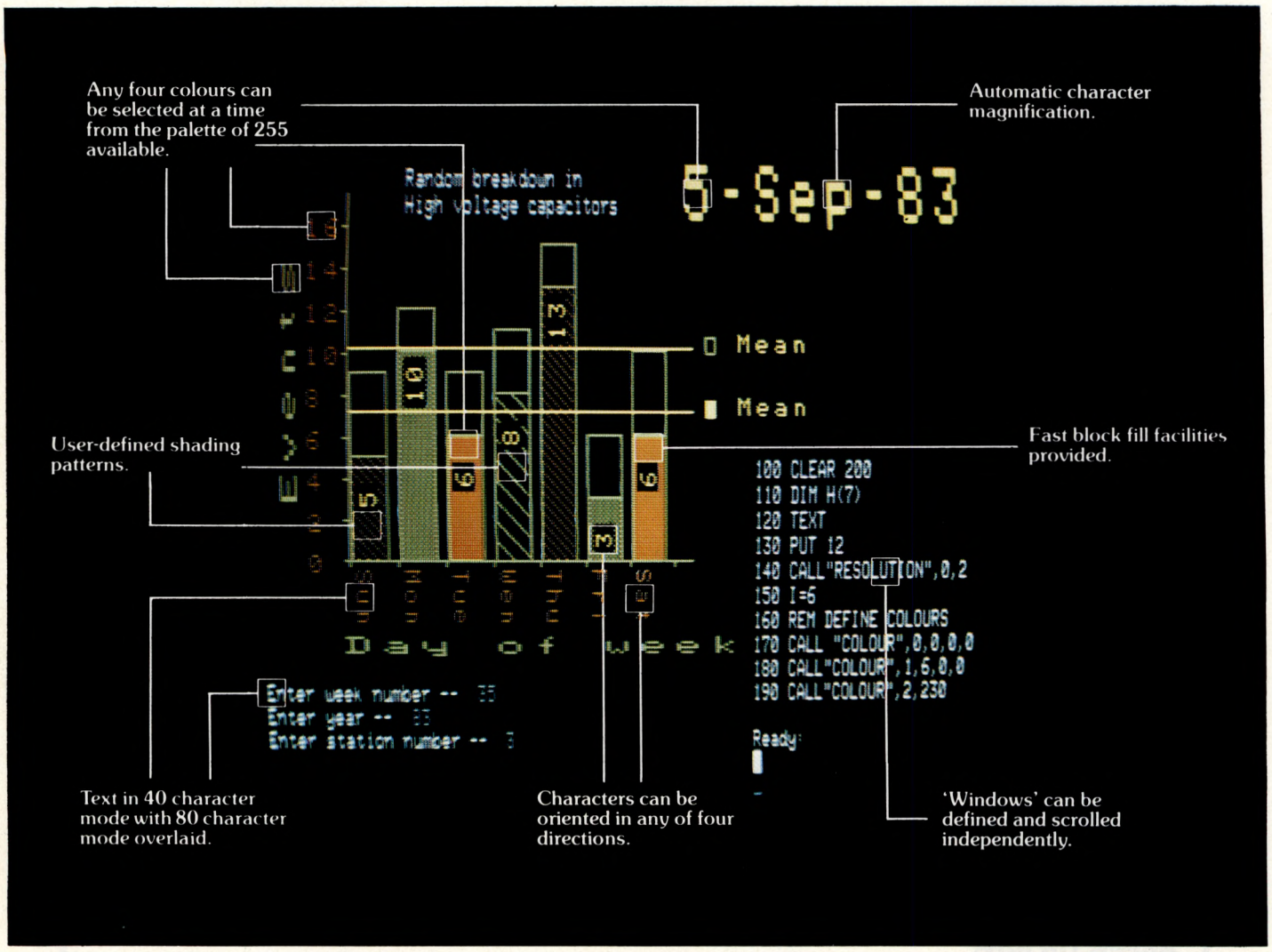

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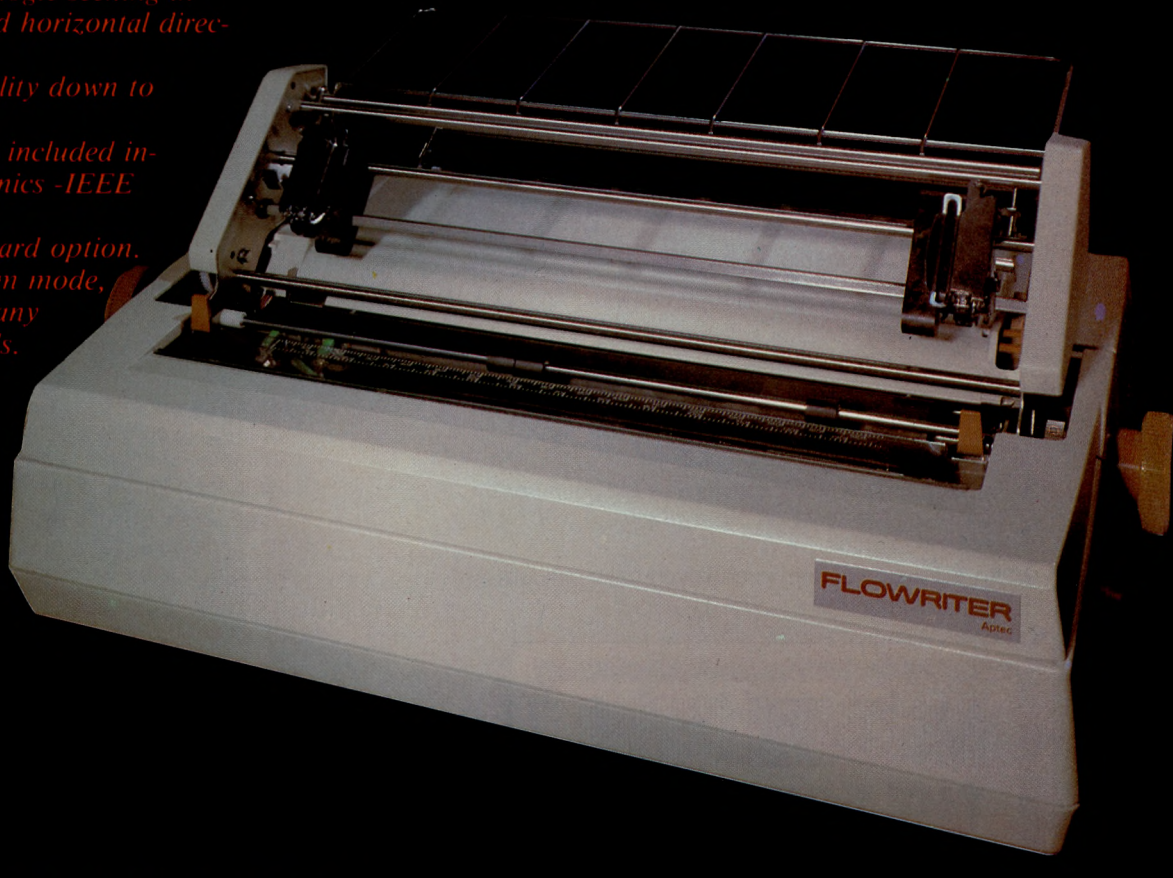

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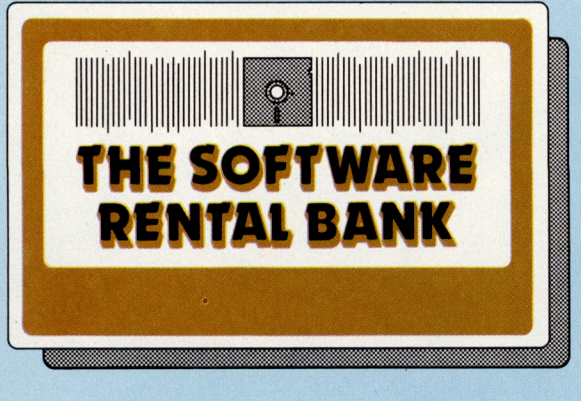

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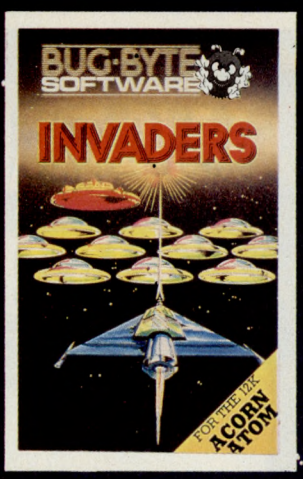

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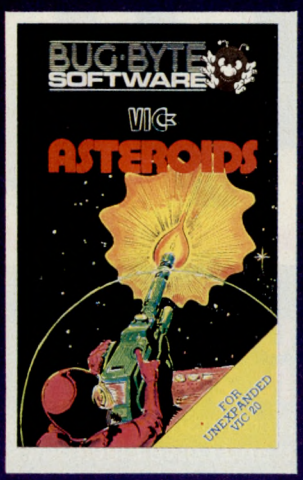

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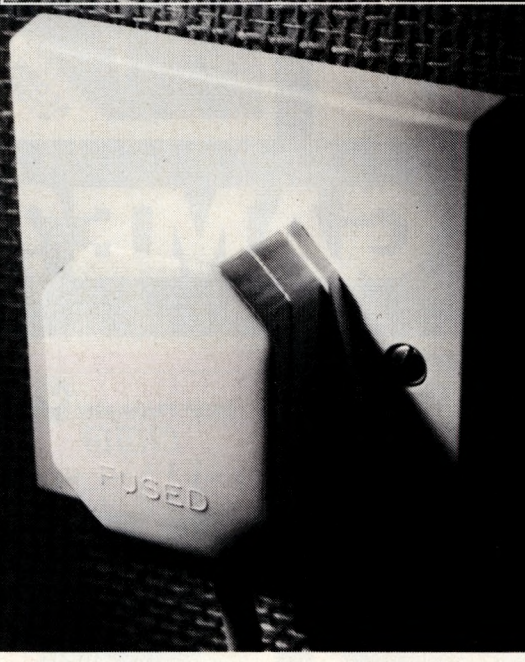

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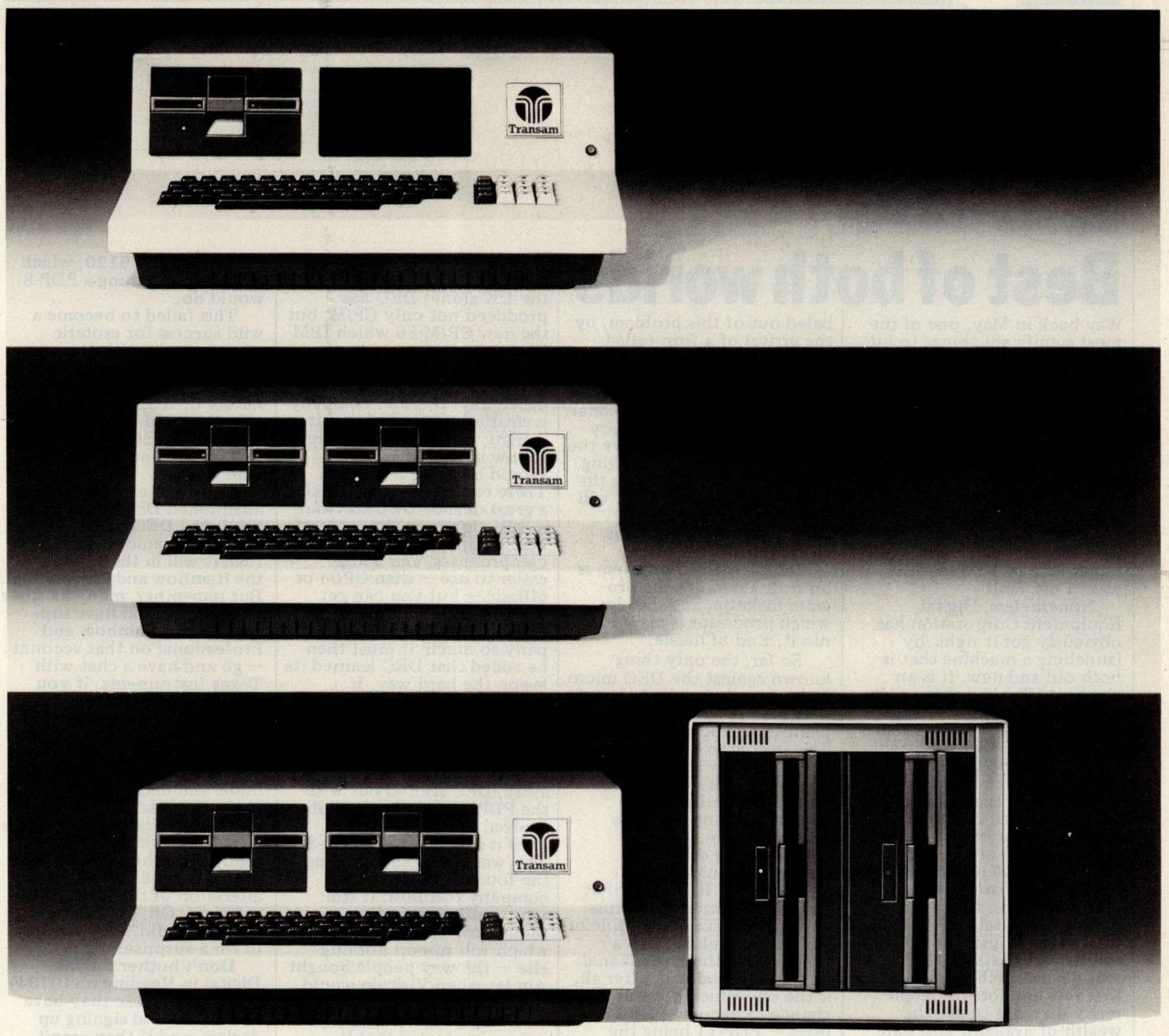

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Best of both worlds

Way back in May, one of the most significant things to hit the micro industry next year started poking its first shoots tentatively through the soil, when the world's second biggest computer company and biggest minicomputer company, DEC, announced its micro family.

Then, somehow, one of the less significant things of the year happened, and the news of this cataclysm failed to get into *PCW*. I swear it wasn't my fault.

Nonetheless, Digital Equipment Corporation has obviously got it right, by launching a machine that is both old and new. It is an eight-bit CP/M machine with an ordinary eight-bit Zilog Z80 processor, and it is also a 16-bit machine with a bright new Intel 8088 processor, as used by IBM and Sirius.

On top of that, Digital has backed its own design of minicomputer by launching a micro version of it — something which all minicomputer makers do in order to flatter their own egos. In this case, however, Digital's pride in its mini range is justified by the simple fact that it is the world's best selling mini, and that lots and lots of people really do want to use the wealth of available software that has been generated for it — in marked contrast to those who wish that somebody really would sit down and write a wealth of software for things like the . . . . well, the rest of the minis.

The two machines are called Rainbow and Professional, with the Rainbow being the really interesting one that runs CP/M and CP/M-86. It is the only machine in this market which will do this bar some minority interest machines which sell at considerably more than DEC's £2,300 odd.

To everybody else, the choice between established, eight-bit micros (which have lots and lots of software ready to run under CP/M) and exciting, powerful 16-bit micros which will one day have even better software, has been agony. Not to Digital: it has calmly put both eight and sixteen bit processors in the same box.

More: it has ensured that you needn't bother about which micro runs which program.

IBM has been (sort of) baled out of this problem, by the arrival of a firm called Xedex Corporation, which launched a Zilog Z80 processor, on a board, ready to plug into the IBM Personal Computer and run ordinary CP/M. But you don't have the mindless ease of just shoving in a diskette and pressing the start button, which DEC will give you — because Baby Blue's operating system is either one, or the other.

DEC's operating system is both. It examines the program diskette, and decides which processor is meant to run it. End of hassle.

So far, the only thing known against the DEC micro is the fact that nobody has seen one. It was originally planned to appear in October. This is now to be delayed, and internally executives predict that it will be available in December, but 'better say January to be safe', they say.

Any other computer company would have launched the Rainbow (if at all) with a minimum of fuss, and would have given pride of place in all publicity to a range called the Professional.

The Professional, after all, is the one which gives us all a chance to become PDP-11 users — PDP-11 being the name of DEC's enormously successful range of minicomputers.

The Professional Operating System (P/OS) is derived from base-level RSC, which is Digital's real-time operating system (real-time is what nearly all micros have) for the PDP-11 family.

Digital is as proud of its PDP-11 family, and the design mannerisms which went into it, as its old rival, Data General is of its Nova families. DEC, however, has not restricted itself to offering the Professional the way Data General has restricted itself to Nova lookalikes. Indeed, where DG has, reluctantly and haughtily, condescended at last to offer a non-DG operating system as an option, DEC has put the Rainbow in front of the Professional in its publicity handouts.

And where DG has, inexplicably, refused to allow CP/M to cross its threshold (and has gone for the Business Operating System originally developed by CAP Microproducts, which it describes as a mainline operating system as though there were tens of thousands of users in the UK alone) DEC has produced not only CP/M, but the new CP/M-86 which IBM has backed.

Strangely, one might have expected things to go the other way. If either company is entitled to a belief that it is right, and the world should follow in its footsteps, it should be DEC, not DG. There can be no question that a great deal of DEC software is 'superior' — in the sense of being more powerful, avoiding compromises, and being easier to use — than CP/M or MBasic — but you can get both on the Rainbow.

Having praised the company so much, it must then be added that DEC learned its lesson the hard way. It launched a microcomputer two years ago. What! (you say). A DEC Micro, and I never heard of it?

Well, long ago and far away, DEC started out with the PDP-1, and after a while evolved through -2 and -3 until it arrived at the PDP-8. This was a wild success, and the foundation of the company fortunes. It still sells, just because there are things written for the PDP-8 which will run on nothing else — the way people bought Apples when Visicalc would run on nothing else.

A company called Intersil was so impressed that it produced a microcomputer chip called the 6120, which would do anything a PDP-8 would do.

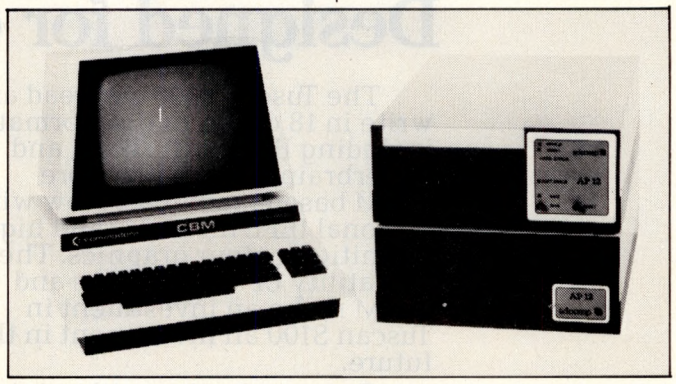
This failed to become a wild success for esoteric reasons to do with the non-volatility of magnetic core memory and the non-alterable nature of ROM. Digital, suitably flattered, installed this chip in its DECmate micro.

It still failed to become a wild success.

The company has not abandoned DECmate: it has produced DECmate II, which might have sold rather better than it will in the shadow of the Rainbow and Professional. But remember, many another company would have suppressed the Rainbow and Professional on that account — go and have a chat with Texas Instruments, if you don't believe me.

Interesting subsidiary features of the DEC range: they are all equipped to send data direct to ordinary DEC minis and maxis (the Vax is a maxi, because DEC says it isn't a mainframe and I refuse to call anything that big a mini). And they all accept plug-in hard disks without alteration of the operating software. Oh, you thought any micro did? Boy, are you in for a surprise!

Don't bother ringing Digital in Reading on (0734) 868711, because they have already started signing up dealers, and if they aren't talking to you already, you



A German-supplied hard disk for Commodore machines, the Adcomp drive, has the unusual feature of being connectable to 16 PETs at once. The system apparently 'understands the CBM 8050 Basic Instruction', a German-language derived phrase which I take to mean that it emulates the 8050 floppy drive and will obey operating system commands normally used for the 8050.

Users can normally have their computers as far as 20 metres away from the disk, and they can even be as much as a kilometre away, providing they use the special long-distance cable driver. The only thing I can't tell you about the system is the price, because I couldn't get through to Mr J Genius (yes, really!) on 089 19 40 19, which is a Munich telephone number. The firm is Adcomp Satensysteme GmbH at Horemansstr 8, D-8000 Munchen 19.

See 'Phone Foul-up'

don't count. And if you just want to buy one, they haven't got any yet.

Name game

Not to anyone's surprise, I hope, Future Technology Systems has decided that Future Technology Limited is a company name that will not do, and has invoked the Registrar of Companies as authority to stop its rival. Watch this space for further news.

Turbo PET

It doesn't really matter all that much, usually, how fast your computer is at finding information on a disk. However it starts to matter a lot when 12 computers are using the same disk and you have to wait 12 times as long.

Stack, a company which sells a simple method of attaching any PET computer with Basic 4.0 to an 8050 disk shared with several other PETs, also sells a go-faster program to cut the queues for the data. It's called Turbo ROM and it can be installed as an exchange for one of the normal PET chips.

Details on 051-933 5511.

Phone foul-up

Recently, Lion House Micros and I collaborated in an experiment to transmit a 12k byte program down the phone line in hex dump format via a central computer store.

It took well over 80 minutes to transmit — when it worked. The whole first day was wasted because of noise on the line which completely garbled the characters — and the phone kept on ringing up the charges.

It took only around 20 minutes to load, because error checking wasn't available. A pity, because after three separate loadings, it wouldn't run reliably, and obviously had about five characters out of the 12,000 garbled.

These experiences have deepened my character and I can't blithely accept that the Owltel downloader, which retrieves programs from Prestel for running on the Apple, is really effective on programs much over two or three kbytes in length.

Owl Micro-communications recommends using the package for the 'wide range of educational, games, and utility software now becoming available on Prestel', I recommend sticking to the short ones.

Full details on Bishops Stortford (0279) 723848.

Virtual virtues

An awful lot of people (for example, those who use the Wordstar word processing program) know that it is possible to run a program that is too big to fit into your computer by 'overlaying' bits of it as required — and they are normally very puzzled when firms like Zilog announce 'virtual memory processor units which eliminate the constraints placed on application programs due to main memory size'.

The essential difference between overlay and virtual memory management is that you have to work out the overlaying yourself, but the computer does it for you if it has virtual memory. Neither of these is 'virtual machine' operation, which goes one step further, and overlays the operating system and job control instructions too.

A virtual memory computer programmer sits down and writes code. He (theoretically) doesn't worry how long it is, but hands it over to the compiler, which generates a nice sequence of machine instructions, which it in turn passes to a loader, which feeds it into the computer memory and tells the processor to start at the beginning.

At some stage, the virtual memory management unit notices that the computer is about to access a memory location which doesn't exist. It only goes up to (say) 65535 memory bytes, and is now sending out a request for the data in byte 78009. Hastily, the virtual manager interrupts, fetches 78009 onwards from the disk, and re-labels it so that it actually starts at number one again.

The drawback is that all too often 78009 contains a quick test which turns out to call for location 25008, which is now location 46999. Processing stops while the new section of program is stored on disk again, and the old lot fetched back out. This can go on and on; it's called 'thrashing' and, in reality, programmers have to watch out that they manage their plans so as to avoid it.

Nonetheless, you don't get omelettes without breaking eggs, and the omelette is a genuine increase in the ability to write programs in languages like Fortran, without worrying how much memory the user will have to have. In other words, to write programs for nearly any machine that can run the compiler.

The chips which Zilog has announced are the Z8003 and Z8004 processors, which will run all software already produced for their predecessors, but will also organise longer programs into segments. The difference is that the Z8003 generates 23-bit addresses organised into 128 segments of up to 64 kbytes each, while the Z8004 generates 16-bit addresses.

The chips will actually start being available around the end of this year. Details on (0628) 39200.

Advance warning

The exciting thing about the ZX Users' Fair to be held in Pudsey in October is not the fact that it will be in the Pudsey Civic Centre, Stanningley from 10am to 5pm on Saturday 2nd, nor the fact that there will be a free draw and a £50 voucher to be won. No, it is the simple fact that Northern Premier Exhibitions have told me about it in time to get it in the issue before the Fair happens. You may even have time to book a stand of your own if you've invented something clever for Sinclair computers. Details on (0532) 552854.

War of the words

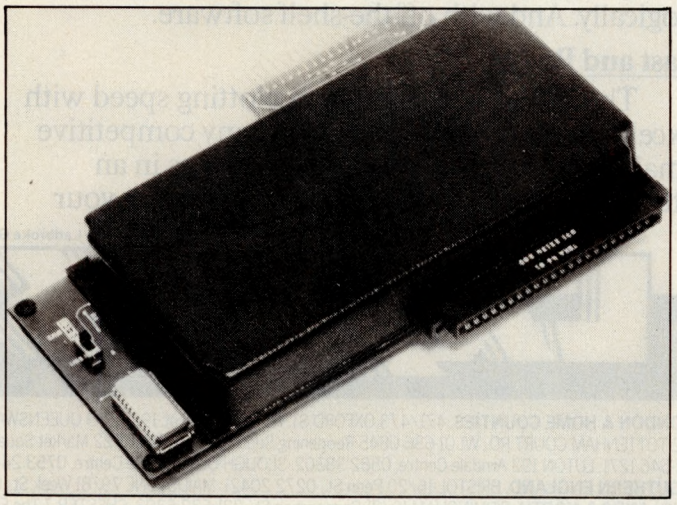
The gentle hint of a future war between word processing machines and microcomputers is revealed in a £35 market report from Key Note Publications on the business of processing text.

The report spends much of its time analysing the different types of word processing equipment, all the way from memory typewriters to micros but notes that while micros are starting to sell into the office typing market, there is now some signs of a trend the other way. That is, word processors are starting to handle some computing.

'Many hardware suppliers are now offering additional software to convert their word processors into management information systems, especially accounts, payroll, and financial modelling,' the report notes. 'Some are even offering standard Microsoft Basic so that their word processors can be used as microcomputer emulators.'

However, though word processing machinery is cheaper than it once was, it still isn't down to general purpose micro levels. Some word processor machinery costs 'as little as' £4000, notes the report.

'To become really competitive with general purpose microcomputers, word processors with extended capabilities would have to come down in price by some 50 per cent,' Key Note says. 'At the moment, they only



Stack originally released an add-on memory board for the VIC users that gave 3 kbytes for £49 — and promised that one day it would offer more. This is the more. It still costs £49 and now has 8 kbytes plus the ability to expand and room for permanent programs in ROMs.

One Apple® or Commodore Pet and £1,034 can make a lot of pies.

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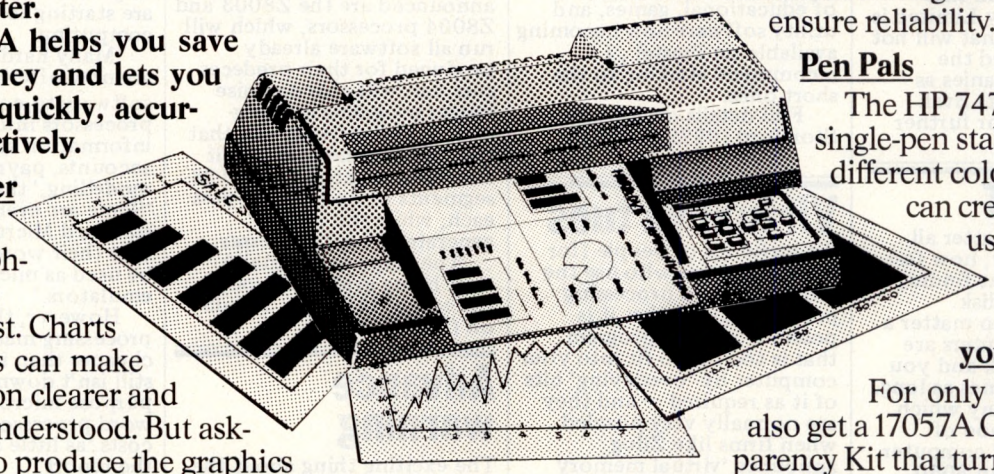

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Data, when visualized graphically, becomes information fast. Charts and bar graphs can make any presentation clearer and more readily understood. But asking your staff to produce the graphics for your next presentation doesn't ensure accuracy or artistic talent. And going to outside suppliers can be costly. Combined with your Apple® or Commodore Pet Computer, the new HP 7470A plotter does the communicating for you. Quickly. Logically. And with off-the-shelf software.

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really attract large organisations seeking standardisation and/or compatibility with existing systems.' What I call people with more money than sense . . . anyway, the report is available from 28-42 Banner Street, London EC1Y 8QU.

Bubble blowing

Two chip-making companies, Motorola and Intel, are not normally very cooperative so the announcement of an agreement between these two to cooperate on developing Intel's range of bubble memories either proves that the project is very complex and needs heavyweight effort, or that neither side is really too much bothered.

Bubble memory is semiconductor memory that doesn't evaporate when the power is disconnected but it is slow and it hasn't turned out to be as cheap as was first hoped. It was seen as a possible rival to disks when disks were expensive, and nowadays is more realistically viewed as a sophisticated way of producing a disk system that can't get clogged up with dust or that can be bounced around.

The two companies agree that we won't see any of these new bubbles arising from their joint splash until middle of next year at the earliest, from which you can deduce that products with these bubbles in will have to wait even longer. So don't sell your disk company shares just yet.

Sparky's magic

'The most exciting and novel development in the piano world today,' (says the Cambridge Pianola Company — yes, really), 'is the bringing together of a piano and a home computer.'

The purpose of this exciting and novel development is 'so that they can communicate with each other'.

The idea is enough to make strong fans of Stockhausen quail but I think I have grasped the essentials, and what it means is this: you remember, don't you, the sort of game you play on microcomputers where they have programmable BEEP functions? You randomise the value for the BEEP and do a FOR . . . NEXT loop, and listen to a tiny loudspeaker doing a random walk through the audible spectrum.

Well, now you can do it with a piano instead of the tiny loudspeaker.

'A home computer can invent music,' remarks Cambridge Pianola with breathtaking understatement and oversimplification. 'The piano can play directly from a computer program in Basic, producing an infinite number of variations. It can also be programmed by a musical dunce, to play any score from Scott Joplin to Mozart.'

If you like this sort of thing, then this is the sort of thing that you will like. Consider: 'piano music can be composed and played without regard for the limitations imposed by the pianist having only human fingers'.

The complete kit will cost £1600 plus VAT. It includes the normal pianola device called a pianocorder, which presses piano keys down, and a Sinclair ZX81 which tells it which keys to press. You can have music without regard for the limitations imposed by humans only having human ears.

For details, contact Thomas Poole on Cambridge (0223) 861348. Better yet, get a time machine and return three years into the past, and blast Uncle Clive before he invents the damn thing.

Osborne upgrade

The good news from Osborne is that it will supply Pascal/P-System (some say free, but that hasn't been confirmed in the UK) with the upgrade of the Model 1 to a dual-density disk system.

The bad news is that Osborne isn't happy with the dual density controller circuitry, and has postponed its release until January. Apparently too many systems were crashing with CP/M error messages, and there is no better way to infuriate a user than to display a CP/M error message in the middle of his most complex account billing run — because a CP/M error message means 'go back to where you were when you switched on this morning, and start again, because I've just wiped the lot out'.

Details through dealers.

Here comes Hitachi

Japanese giant Hitachi is all set to launch its 16-bit business micro in the UK early next year. Although billed by some US mags as an 'IBM lookalike', the Hitachi Personal Computer actually has a higher spec than the basic 'baby blue'. Try this for size: 8088 processor, 128k RAM, 192k video RAM (that's 64k each for red, green and blue), 640 x 400 graphics resolution in 16 colours (you can have eight on screen at any one time), 80 x 25 text display, 655k twin minifloppies, MS-DOS, Microsoft Basic and an internal expansion bus which will be compatible with that of the IBM Personal Computer.

Fortran, Pascal, Cobol and Basic compilers will be available, together with an assembler, Multiplan and a 'standard' word processing package. Add-ons and options include 5 and 10 Mbyte winchesters and — probably — Hitachi's 500k 3in microfloppy disk drives. A large number of applications packages, aimed especially at the business user, are also planned.

As well as setting up a dealer network, Hitachi plans to establish a chain of support centres across the country, where both dealers and end users can be trained and where small businessmen can receive introductory teach-ins.

Peter Rodwell

IBM clones

While we are all waiting for IBM to find somebody with enough nerve to struggle up the cargo loading bay with its Personal Computer and launch the damn thing in the UK, all is not yet sweetness and light in America.

Two minor niggles have provoked outside manufacturers into trying to compete with (or improve on) IBM's design — one is the keyboard, the other the display.

It is known that IBM's monochrome display is slightly unusual in that it has 'high persistence' — that is, the glowing characters on the video screen fade slowly. If the screen scrolls it is almost impossible to see what is going on because the screen shows the mixed-up overlays of three or four lines together.

Those who have experimented with a short-persistence display, however, report that it may not be an accident that IBM selected the high-persistence phosphor. There is, they say, a decided flicker which seems to be caused by a hardware or software fault in the display.

Other people, less technically experimental, have been known to reject the IBM Personal Computer because they can have colour or monochrome — but not both.

The display problems are minor niggles, but they have provoked a Michigan company to make the startling announcement that it has 'improved' on the IBM PC by launching the 'Portable IBM Color PC'.

The keyboard is an even smaller niggle but matters more. Simply, the keyboard is nearly unusable by ordinary typists, because the SHIFT and RETURN keys are not where touch-typing fingers expect to find them.

The result is that the very well known keyboard design company Key Tronic in Washington is planning to sell IBM a redesigned keyboard of a more orthodox or up-to-date style.

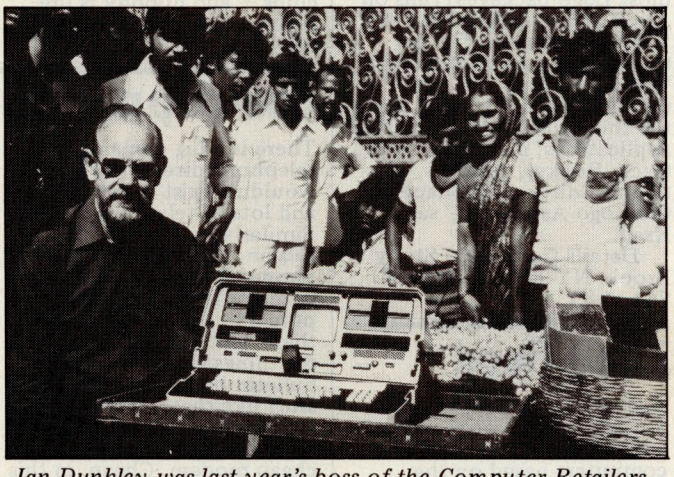
The really entertaining side of the whole business is that while Key Tronic's venture has attracted much interest, the Michigan Color PC has attracted nothing but derision.

The company, Applied Systems Corporation (ASC), seems to believe that the Intel 8088 chip used in the IBM PC is in fact an IBM 8088 chip. It has also announced that it will put the IBM logo on the front of the box.

That's a suggestion to which IBM has yet to respond, but the company has in the past been known to prosecute people (like British computer company ICL) merely for mentioning the letters IBM in their own advertisements, even when saying merely that something was 'IBM compatible'.

The other rather strange thing that ASC says is that it will use IBM's own keyboard.

It is, perhaps, possible that when IBM switches to the Key Tronics keyboard (if it does), it may have a huge keyboard factory somewhere filled with Mexican workers who want desperately to continue to work, and that in compassion for their plight IBM will sell the useless old-



Ian Dunkley was last year's boss of the Computer Retailers Association. This year, he's gone off with an Osborne 1 to Bombay, where our photographer found him sitting in the market outside Victoria Station, apparently claiming to be negotiating a £150,000 contract for precast moulds by Datron Interform, a company which owns Datron Microcentres, of which Dunkley is the boss. It all sounds very strange to me.

model keyboards to ASC — but it will be the first time IBM has ever done any such thing if it happens.

A healthy scepticism about ASC is therefore probably justified.

Meanwhile, those who like the IBM PC but want a bigger and faster version can look to the announcement of a machine called the Gazelle, just emerging from an American firm called Seattle Computer.

Seattle Computer has a distinct edge over most hardware producers who hope to imitate the IBM computer: it was the company that Microsoft commissioned to write the IBM PC operating system, MS-DOS.

The Gazelle, unlike the IBM PC, uses the full 16-bit implementation of the central processor chip. That is, it uses the Intel 8086, not the sawn-off 8088 version, which makes it bigger and faster but allows it to run exactly the same software. This was always the plan, of course, but perhaps few people expected a direct challenge quite so soon.

In this country, of course, the Gazelle will be old hat — Future Technology Systems has been making a very similar machine, with 8in drives and the 8086, for nearly two years.

Price of the Gazelle in America, including MS-DOS, plus Basic (Microsoft) and a word processor program called Perfect Writer, is $6000 but that doesn't include a display or keyboard. So it's not likely to sell in its hundreds for quite a while.

Mock turtle

Yet another version of the Logo language (that's the one that draws pictures by directing an imaginary turtle around the screen with his tail dripping ink) has been launched from New York by Krell Software.

Priced at $99, this one (like most Logo packages) runs on Apple II and is described as a 'no-frills' version. You get three disks, two containing a 'full authorised MIT copyrighted version of Logo' and the third with 'invaluable MIT applications, including Dynatrack, Rocket, Animals, The Sound Editor, The Shape and the Logo Assembler,' says Krell.

Details from 1320 Stony Brook, NY 11790; tel (516) 751 5139.

Zilog flood

Around a year ago, we all noticed (didn't we?) a lot of announcements of microcomputers based on the Motorola 6809, plus the beginnings of software support for those machines. Now the fuss has all faded into the background and we will continue to live in the real world of PETAppleTandy and CP/M as before.

This year we must all try to convince ourselves that the flood of announcements of machines based on the Zilog Z8000, a powerful 16-bit micro, is not a similar silly season hiccup, and that in July next year we will start seeing a small flood of Nat Semi products as a slight intermission to the real world of IBM and Sirius.

Certainly there are some very nice machines based on the chip which won Adam Osborne's White Elephant Award in San Francisco last year (the award was not denigratory but a genuine triumph of tradition over metaphor). Olivetti, Onyx and others are selling, and others will appear.

The good news has been reinforced by Zilog drawing our attention to the fact that its silicon partner AMD has not, after all, backed out of its agreement to make Z8000 devices.

'The unfounded speculation,' said a triumphant Phil Pittman, Zilog UK boss (and ex-Sinclair designer) 'that has been rife concerning a possible rift between Zilog and AMD has now been very firmly squashed.'

He was referring to a new cross-licensing agreement for the whole range of Z8000 processors and support chips.

My own feeling, which isn't much more than opinion, true, nonetheless remains lacking in staunchness of faith, and I still expect the future to be a battle between Intel and Motorola, with Intel eventually winning in 16-bit designs simply by beating everybody over the head with IBM.

One other, small, point which I know Phil Pittman will be grateful for my remarking on: the 'speculation' was not 'unfounded' but 'wrong'. It was founded quite firmly on the news that AMD had signed a deal with Intel, based on the 8086 family of chips — and nobody is pretending that *that* agreement has been ended.

One-chip modem

There is a big demand for telephone directories and it wouldn't exist without lots and lots of telephones. Similarly, when there are lots and lots of computerphones (by which I mean modems that connect computers to the phone lines) there will be a big demand for things like Prestel and bulletin boards and useful stuff like that.

One step towards lots of modems is still missing: a cheap modem. Cheap, in this business, means using only a few chips. And I am therefore delighted to observe that Texas Instruments in France is putting together a one-chip modem for computers and Prestel sets.

The chip will not receive ordinary slow (300 bits per second) communications — which is a real shame, because there are quite a few people around who transmit that standard. However, it may not matter. It will receive at either 600 or 1200 bits per second, and it will transmit at 75, or 150, or 600, or 1200 bits.

Frankly, anybody who has ever used a 300 baud communications line will be delighted at the thought that this might become obsolete, because it is painfully slow. If you have a screen of data coming laboriously onto the display at 30 characters per second you can virtually read it as it is printed — and normally we want to read the bottom line first.

What makes the chip really interesting, however, is the fact that it will, according to TI, work with both European and North American standards — which means that modem builders who use this chip can expect a much bigger market than before — which in turn means cheaper modems.

By this time next year, we may see the first early production systems using it, I hope.

Cash conference

Each year the European Information Providers Association (Euripa) runs a conference, which they call a symposium, and next year they plan to do it again.

This time the subject will be rather more hardline than the previous rather woolly 'Role of the private and public sector in the information industry', and will concentrate on money.

'How to make money out of Information', then, will run from 17-18 March 1983, and details are available from 79 Great Titchfield Street, London W1P 7FN.

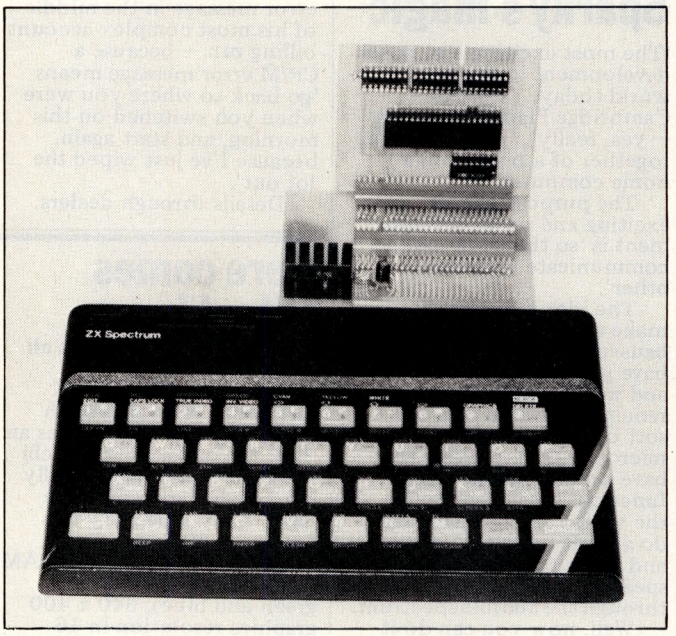
Movie magic

Someone was asking recently what the point was of all this enormous drive to bigger and better machines.

Is it a plot, he asked, a scheme by the industry to get us to make our nice 8-bit word processing and spreadsheet machines obsolete just so we can chase after new 16-bit and 32-bit stuff? Who needs all the 'extra power' anyway? We can't type fast enough to keep up with the slowest micro today. . . and so on.

If any designers are reading, then here is a small inspirational idea along those lines. The first order for the world's most powerful computer available for sale is not from the weather forecasters, nor from the big banks, but from an animation outfit. It makes animated films.

No, it doesn't make cartoons. It uses the new super-Cray processor to plot the individual 'grains' of colour film and simulate photographic action. Working flat out, this outfit (Digital Productions Inc) used to be able



This Spectrum is disguised as a Red Indian brave because it wants to understand the IN and OUT commands. The two commands are on the keyboard but they don't make any sense to people who can't find the right pins on the connector at the back to watch them pulse. This Kempston product provides three 8-bit ports, for input and output. 'It's available fully built and tested together with a set of detailed instructions and control applications,' remarks the manager, Mr Pandaal. It costs £16.50.

A £17 motherboard is available, too. Details from Kempston Micro Electronics at 50 Adamson Court, Kempston, Bedford MK42 8QZ.

to churn out one whole frame in a quarter of an hour on its old Cray. On the new one, it will go a lot faster.

Apparently one frame per quarter-hour is around four minutes of film per month, and the new machine can give nearer half an hour's worth of action in that time.

Your average micro can't do this, nor anything like this. The fastest micro likely to be on the market in the next 12 months or so, based on a chip like National Semiconductor's 16032 (a quasi-32-bit design) would be pushed to plot two minutes' worth of movie viewing per *year*.

The thought, however, is this: drawing pictures is in many ways easier than recognising them. But the power needed to produce two minutes of movie that could be mistaken for camera film could be harnessed to the sort of burglar alarm that could tell the difference between a dog and a human, even if it didn't stand a chance of telling the difference between me and my aunt Maud.

And when Cray machines are priced at the level Sirius machines are today, an awful lot of dreams will suddenly become easy, normal and useful.

Think of the possibilities. . .

Wedded bliss?

The word 'marriage' has been used by software writing company MSA to describe the integration of programs for giant mainframes and for individual micros.

What John Imlay, head of MSA, really means by this is complex, but the essence of the idea is that files of data produced by micros should be intelligible to the central computer in any organisation, and, similarly, that data produced by the central computer should be able to be processed by software running on any micros that the group might use.

As Imlay says, his company is 'in a unique position' to offer a range of software that fits this bill. MSA is, whatever rivals may say, probably the biggest specialist software-producing company in the world and it has bought Peachtree, one of the leading micro application producers.

This is not to say that all MSA software and all Peachtree software is automatically interchangeable. It means that one day, with luck, a lot of the newer stuff will be.

Some examples of the applications to be released over the next few months, according to the company's official statement, will include the following.

First, customisation of financial statements produced by MSA's general ledger, to add late changes, footnotes, etc, using Peachtree's word processing system PeachText.

Next, selection of information from big mainframe databases for use on MSA's Visicalc-type program, Peachcalc, 'for budgeting, planning and management analysis'.

Also, integration of the Peachtree Software order entry system will be possible on MSA's accounts receivable mainframe system, so that local orders can be processed centrally all together.

Possibly the most interesting application, however, is that financial and statistical data produced by each of MSA's systems will be transferrable to micros, and turned into full-colour graphics displays with Peachtree's new Business Graphics system.

What I like about the direction this is going is the fact that the micro side of the partnership is intended to enhance, rather than rival, the central DP department's work. It could lead to more co-operation between established and 'pirate' computer users inside corporations and, from that, the new business computing market will be able to draw rich nourishment in ideas, market opportunities and shared resources.

Genie hi-res

High resolution graphics are now added to the Tandy look-alike Video Genie, for an extra £86.

The new device is the LE18 unit, which uses a separate 16 kbytes of memory to provide a dot matrix of 384 by 192 points, which is some 73,000 points — almost exactly 73 times as many as the Tandy normally has.

New commands in TRS-80 Basic (needed to control this video memory) include PLOT, VECT, FILL, REV, CLR, DISP, HOLD and VIEW. 'In addition, a scratch pad memory allows animation and the use of programmable graphics characters, and the unit can also produce reverse video displays,' says Lowe Electronics.

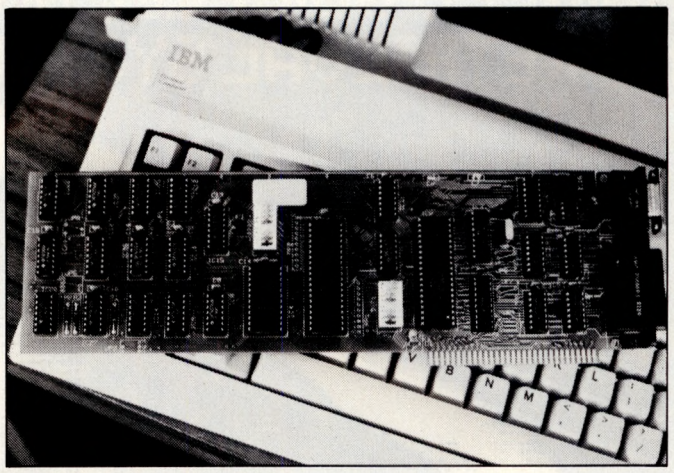
Lowe is the UK distributor of Video Genie, having sold some 10,000 machines here, but this product is its own design. Details on (0629) 2430.

'All right,' says the Squire

What I like most about a certain part-time director of ACT and general micro entrepreneur (Julian Allason is his name) is his irrepressible optimism. It currently covers the new IBM operating system, MS-DOS.

Allason has released a fervent dose of enthusiasm in conjunction with his associate Christopher Preston on a brand new 'Research Brief' which appears to be the first of a series. It is quite cheering to be told, for instance, that 'Microsoft claims MS-DOS is almost 100 per cent compatible with CP/M' or that Allason Associates' tests show the new system to be up to three times as fast at reading disks as CP/M-86.

I hope that in future research briefs we will be offered rather more on the differences than on the similarities. CP/M itself differs from CP/M-86 more than MS-DOS appears to here, and I feel there must be more to it, somehow. But it is all very cheerful reading. Contact Allason at PO Box 2, Goring, Reading RG8 9LN for his future plans.



See 'Tango time'

Tango time

Tango is a dance: it is also the colour, believe it or not, of the paint on ICL computers (hence the fact that people often refer to ICL computers as orange boxes).

A Tango-Lynk, then, is the device which links something to an ICL mainframe. The something is an IBM Personal Computer, and thereby hangs a long tale, mainly about Network Designers and a firm called Telecomputing.

Telecomputing was a software firm which wrote and sold excellent software to allow ICL users to drive their computers from remote terminals. The Telecomputing software was generally agreed to be better than ICL's own software for teleprocessing, and ICL junior operators promptly arranged to do everything in their power to harass the company for showing them up. It ended up with Telecomputing getting close to a million pounds in an out-of-court settlement.

Network Designers is a company with a lot of names at the bottom of the letterhead, which are the same names as used to appear at the bottom of Telecomputing's paper.

What happened was that the company found that they were making a lot of money out of selling their software — but a lot more out of selling an over-engineered, overpriced, and (it turned out) unreliable design of micro made in Australia.

Having disentangled themselves from that group (not without strife) the directors selected a better micro, and have gone back into selling software which helps you to drive your ICL mainframe through a micro.

The only difference is that this time they have picked the IBM personal micro as the box which you sit at. You plug in the board (illustrated) and run Network's Tango-Lynk software.

Anybody who wants to use a different micro to drive their orange box, contact Network Designers on Oxford (0865) 776888. They will probably prove sympathetic.

No scrumping

In this country, Bill Unsworth reminds American readers, the verb 'to scrump' means to steal apples. So to unscrump is to prevent them being stolen, hence the name U-NSCRUMP for his software protection device for the Apple II.

Unsworth notes that hardware protection of software is 'more attractive' than disk protection because it allows backup copies to be made of program disks, and also allows the user to run the program on hard disks or on 8in floppies.

U-Microcomputers plugs the device into the expansion bus, not into the games port, which allows the user to have the games port working but clutters up the bus.

The device is now available for evaluation at £28, and at that price, notes Unsworth, 'will be used with the more expensive business, scientific, and professional packages'.

I don't want to spoil his market, but beside the simple fact that I hate these protectives, I really query their value.

Whatever theory you may produce to explain 'lost' revenue due to pirates, you will still be the first person to manage the trick, if you can produce any evidence that software houses which use protectives make any more money than those which don't.

Visicalc has made a mint and is theoretically 'protected'

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and all I can say to that is that it has also made a mint for the bright sparks who sold programs to unprotect it. Wordstar has made a mint, and isn't protected at all from the user.

Anyway, Unsworth is on (0925) 54117/8 in Warrington.

Not as bad as it sounds

A good indication of the strength of a new product is the list of things that the proud inventor compares it with. The inventor of the Nippon-Univac micro compares it with the IBM Personal Computer (not launched in the UK), with Burroughs' new micro (can't recall hearing about it, can you?) and the enormously successful Apple III, of which so many have said 'when is Apple going to launch the Super II?'

In other words, it's slower than a speeding bullet, can leap over the Empire State Gutter in a single bound, and so on — you deduce. Well, no, it's a bit better than that.

It actually looks to be a reasonable middle-of-the-road sort of beast, capable of selling a thousand or so systems if only it had been launched a couple of years ago. For just under £2000 you get an 8085-based system with CP/M 2.2 and two medium-capacity small disks. That compares reasonably well with the ICL Personal Computer which 'stands out from the crowd' as Martin Banks so caustically observed last month.

Distribution is (sensibly, I would say, in the circumstances) not going to be done on the scale that ACT is pushing the Sirius 1, but will be 'a small distributor network in the UK', according to Peripheral Hardware Ltd, the importing outfit, which can be contacted on 021-745 3033.

Psychobabble seminars

Computertown USA may have inspired David Tebbutt to start pushing the idea of ComputerTown UK — but the two projects are as unlike as cricket and baseball.

The American version started off as a club in the Menlo Park (in the middle of Silicon Valley) library, for children. It has now become a 'microcomputer literacy project funded by the National Science Foundation' and has announced the selection of its 'official Western US Test Site', in Wenatchee Valley College (in Washington State).

The idea of a Test Site, it seems, is to develop a 'package' which provides 'suggestions for creating hands-on, public access events, conducting workshops, giving classes, establishing outreach activities, and locating and procuring funding and support,' remarks my handout incomprehensibly.

I wonder if the Americans know what 'quango' means.

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I wonder if the Americans know what 'quango' means.

Cheap but outmoded

Texas Instruments in the US is singularly stubborn about admitting to problems on the basic design of its 99/4A 'home computer' which has received new price cuts here in the UK.

The company says that this year is the beginning of the 'long-awaited' boom in home computers, according to American journal *Electronics*, and is accordingly diverting production resources from the 'soft' terminals market into the 99/4A. The company has already got production economies to the point where it can be sold for $199 in the US.

Even so, I'll be surprised if that makes it the success of the decade. It's nice that it can talk — but what else can it do that isn't way out of date? Can it play Pac-Man?

Come on Texas, give us a really new design. You can do it, you know you can.

Not surprisingly, the price cuts in the US have been reflected by a drop here, too — to £200.

The company has also announced expansion facilities. You can now buy the illustrated box to plug expansion cards into, plus a floppy disk drive.

Mega-memory

Two megabytes of disk on a Nascom computer would be something to nod solemnly about, say 'nice' and forget. Two megabytes of silicon chip memory, however, is something else.

The trick has been done by MAP 80 Systems, which has produced a memory board with 64 kbytes of memory chips on it, for £150. That includes all necessary decode circuitry for the expansion of up to eight such cards, which can take a total of 256 kbytes each.

The method that MAP 80 has used is to treat the memory as if it were a very fast floppy disk, which means that you can abandon your silly dream of writing a single program two megabytes long. And of course you will have to adapt your software to the system to take full advantage of it.

But the trick is now quite widely done, and it is nice to see it performed on the Nascom family, which includes the Gemini and new Galaxy range of machines as well.

Details from 333 Garratt Lane, London SW18; phone 01-785 9721.

Neat hi-res

A quick trip to the Notting Dale Technology Centre recently revealed, in the middle of a mass of micro bric-a-brac, a rather neat little graphics add-on for the ZX81.

'81 owners who, for varying reasons, would rather keep their old faithful than sell it and fork out for a Spectrum can upgrade the graphics powers of the ZX81 to a higher-than-Spectrum resolution for just £27.50.

The graphics board will allow you to define your own characters using POKE in a rather similar way to the Spectrum's use of BIN and to fill in shapes in varying shades and textures. It adds considerable power to the individual ZX81 graphics commands to enable the use of this extra capability without your having to learn a whole lot of new reserved words.

The only serious limitations it has are that it cannot be used with some of the 64k RAM packs, as these use areas needed by the board.

The board needs at least 8k of RAM but cannot be used with some 64k RAM packs as these use areas of memory required by the board. Also, the G007 (to give it its proper name) makes the ZX81 behave in a rather odd way, compared to its normal habits and this is a little hard to get used to at first. However, the board comes with full and clear documentation which explains what you can expect to see.

The board was designed by Gary Keall, originally as a hobby project and is now about to go into production at Information Technology Centres throughout the country. It will be on sale from 1 October. For more details contact the Notting Dale Technology Centre on 01-969 0819.

Maggie Burton

Top of the pops

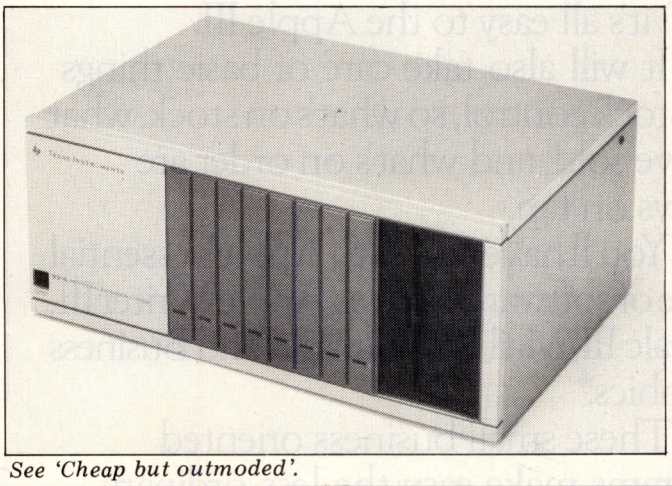
There are some cyincs who feel that the micro business is rapidly becoming a branch of show business, complete with smash hits, cover versions and superstars. What is needed to support this jaundiced view is a hit-parade; a micro Top Ten.

BIS-Pedder have for nine years published an annual Census of Information Systems and in a recent press release they summarise some of the findings of this year's survey. The whole thing makes fascinating reading as it documents the spectacular plunge in mini-computer sales. But the really fun part is a pair of tables which rank the numbers of units shipped in 1981 for general purpose computer systems under £15,000. These have in effect become a hit parade for personal computers as the mini-manufacturers slip out of the top ten.

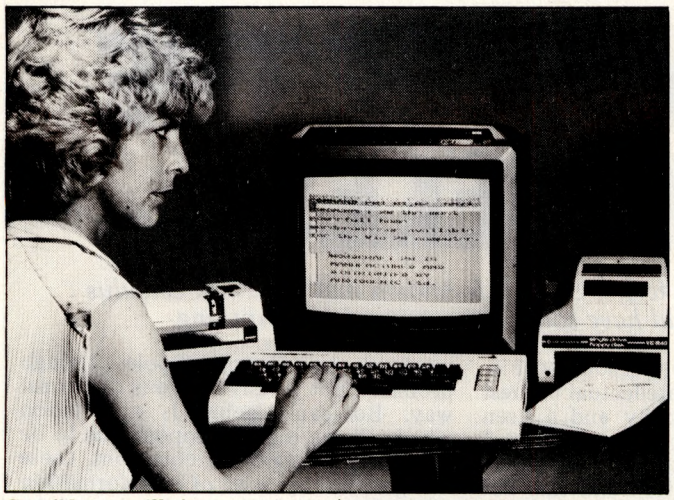
One difference between records and computers of course is that there isn't a standard price, so you have two top tens; one by units shipped and one by value shipped.

Here then are the top of the pops in 1981:

% of units shipped	
Sinclair	43.3
Commodore	8.8
Acorn	6.7
Lucas/Nascom	6.6
Apple	5.7
Lowe(Video Genie)	3.6
Sharp	4.4
Tangerine	2.6
Tandy	2.4



See 'Cheap but outmoded'.



See 'Not so silly'.

Intertec (Superbrain)	1.5
% of value shipped	
Apple	14.2
Commodore	9.2
(Olivetti)	4.4
(CAI)	
Tandy	4.1
Data General	3.4
Intertec	3.2
Sinclair	2.9
ITT	2.3
BCL	2.2

These are only figures for new business in 1981 and don't reflect the size of the installed base. If you need more comprehensive information on the state of the micro marketplace get in touch with BIS-Pedder on 01-633 0866 (Philip Hammond or Derek Pedder).

Not so silly

You have to give Audiogenic some points for candour, in launching the well-known Commodore PET-based word processing package on the 20-characters-per-line VIC. Not everybody in the world would actually display a photo of what the text looks like if it looks like this, would they?

For those who don't have a VIC, however, it is worth saying: it looks sillier than it is. Remember, those who actually do have one will probably want to write notes with it some time, and now they can. The rest of us have been warned.

You buy the software as a plug-in cartridge for £125, including an extra 8 kbytes of memory. Details from Audiogenic at PO Box 88, Reading, Berks; tel 0734 595647.

A fit of the vapours

We *PCW* types love good esoteric jargon; we have crazes which last for weeks on particularly barbarous jargon words. Sometimes we go as far as to deliberately introduce them into articles as a sort of private joke or dare, but usually we restrain ourselves and keep them for office circulation only. A favourite for many months was 'orthogonal' used in such contexts as 'this coffee isn't very orthogonal' or 'that's a rather orthogonal shirt you're wearing'. 'Functionality' enjoyed a considerable vogue, especially when combined into such hybrid horrors as 'just nip out and probe the periphery of the functionality envelope of the coffee machine please'.

We were therefore tickled pink when Chris Buckham of ACT brought us back a real live specimen from the West Coast, namely 'vapourware'. This fascinating concept refers to software which has been announced but doesn't exist yet; there is a lot of it about (or not about, depending on the philosophical school to which one belongs). We don't imagine that Chris heard the word used in connection with any Sirius products of course.

The principle established in an excellent one and we hope to add to the list of 'wares'; for instance 'fogware' could be undocumented software. We leave the definitions of 'rubberware', 'noware', 'someware' and 'edgeware' to the readers.

Bludners extra

There were a couple of bugs in the DIY Logo program printed last month (page 156). Here are the corrections needed.

The QUIT statement mentioned in the article is not in fact implemented in the listing. To make it work add this line:
4084 IF SYS$="QUIT" THEN I=0 : GOSUB 9010 : GOSUB 28000 : GOTO 4200

Set K8 in line 10050 to 35 and add this line:
10170 R$(34)='QUIT': R$(35)="AND"

This also corrects a bug which would have allowed you to define a procedure called AND despite the fact it is a reserved word.

Finally the RIGHT statement as written in fact moves left on the screen! To alter this change AN-C(S) to AN+C(S) in line 23500.

Some readers have queried the ON. . .GOTO in line 20130 which has three apparently unresolved line references. These values should never be selected unless there is a typing error somewhere else in the program. If it disturbs you it would be best to write error traps for the three lines involved, 23600, 23700 and 23800.

This picture is a good example of the limitations of providing information on paper, printed in black ink. If PCW *was an entirely electronic magazine (and who knows, maybe it will be in 10 years' time), you would be able to appreciate to the full this picture of Rair's latest terminal, the ColorScan 10.*

As its name implies, it's a colour terminal and can display up to 256 'unique symbols' per character set, which, says Rair, is 'especially useful in business applications requiring display of forms or bar charts'.

In case you're one of the few people left who seriously think colour computers as strictly for games, let me remind you that colour actually provides an extra information channel - and for that reason we'll be seeing a lot more business computers with colour as standard, soon.

One thing which Rair (phone 01-836 6921) doesn't say about the ColorScan 10 is it's price, so you can be sure it ain't cheap!

'I'm sorry, Mr Harris, but being able to get by in Pidgin-Fortran isn't quite good enough.'

無名天地之始

NAMER OF THE NAMELESS

Dick Pountain writes on a little-known mathematical calculus which could have some importance for computing.

In 1969 I was a newly graduated biochemist with a keen intellectual interest in maths and philosophy and a keen practical interest in pharmacology. I shared a flat in Notting Hill with several others of like inclination and this flat was filled with many esoteric books of great obscurity. One day I perused a book called *Laws of Form* by G Spencer-Brown. I was unable to understand it on that first reading and decided that it was probably cranky, like most of that mountain of books. It left an impression, though, and I never forgot it; I had a vague feeling that it might in fact have been profound, and felt a certain guilt at not having persevered.

Some eight years later I was flicking through my *New Scientist* when I came across a news piece: the Four Colour Map Theorem had been proved. This famous theorem of topology had resisted proof for more than a century and was a kind of Everest for topologists. It had been proved by one G Spencer-Brown using a fairly short and elegant proof. Around the same time a group of Americans reported a proof by a brute force method using some hundreds of hours on a fast mainframe computer. My mind was forcefully sent back to *Laws of Form* (which had long since disappeared along with several of the people). I scoured Foyles, Dillons and such only to find that it had been out of print since that first edition. Eventually I found a mathematician friend who had a copy which he grudgingly parted with for two weeks. In those two weeks I read it again three times making some progress but still being very far from understanding it.

About this time my involvement with *PCW* began and I raved somewhat intemperately about the book to David Tebbutt, the new editor, one day. Some weeks later he returned from his first visit to the West Coast Faire and presented me with a brand new copy of *Laws of Form*. It is alive and well and published in paperback by Dutton of New York. According to David it has a certain following among the Artificial Intelligence community in Stanford.

I'm telling you all this to persuade some of you to seek it out and read it because of my faith in the personal computing idea; with so many people out there now possessed of computing power it is just possible that one of you might use the concepts contained in *Laws of Form* to stand computing on its head. I doubt that it will be me, unfortunately.

Laws of Form is about logic — sort of. In fact it is about something below or behind logic. Anyone who knows Basic knows something of the algebra invented by George Boole, though probably not in any rigorous or formal way. Boolean algebra is a notation which allows logical propositions to be expressed as algebraic equations, these being solved by a set of transformation rules to establish the truth value of the original proposition. In Basic it shows up as your AND, OR and NOT and those flag variables which only have the value TRUE (1) or FALSE (0).

Now algebras are abstracted from arithmetics (a+b=c expresses the form of all such arithmetic sums as 2+3=5, 4+5=9). But Boole's algebra was born fully grown as an abstract system to solve problems in logic. The lack of an arithmetic of which Boolean algebra is an abstraction went without notice for 120 years until G Spencer-Brown (aided by his late brother D J) produced this arithmetic. This is the subject of *Laws of Form*.

This arithmetic is non-numeric and is very simple indeed; so simple that it is extremely difficult to understand. That is not just a cheap paradox. Spencer-Brown (GSB from now on, begging his pardon) devotes a preface to warning of the difficulties in store for the reader; these are not due to any mathematical jargon, for the book is written in plain and nicely turned English and doesn't require formal maths training to read. The difficulty will be just as great for mathematicians as non-mathematicians because he is describing concepts which are almost too simple to be expressable in language. The notion of number and counting is formed very early in human beings (some people believe it's innate) and it is an obstacle to understanding concepts which are more primitive than itself. GSB's Primary Arithmetic is easier for amoebae than humans.

The argument starts from the idea of distinction. A distinction 'severs or cleaves' the space in which it is drawn, like the circumference of a circle in a plane. The space is now in distinct parts and one part can only be reached from the other by crossing the boundary drawn by the distinction. This act of crossing is given a symbol ⌐ which is in fact the only symbol in the arithmetic. It represents the 'marked' state (a distinguished state). The unmarked state is represented by a blank space . I should hasten to point out that GSB develops this rigorously. I'm cutting corners for reasons of space and pace.

Two laws, the law of calling and the law of crossing are taken as axioms and lead to a pair of primitive equations:2

⌐ ⌐ = ⌐

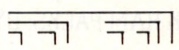
and

⌐ ⌐ =

and the calculus based on direct deri-

BRAIN DUMP

vations from these equations is the Primary Arithmetic. Expressions made up of any number of these 'crosses' to any depth of nesting can be produced and simplified to give a value which is either ⌐ or . An example is



which has the value ⌐ .

Small wonder that the opening page of *Laws of Form* contains a quotation in Chinese from the Tao Te Ching which goes 'The nameless is the beginning of heaven and earth. The named is the mother of ten thousand things.'

At this point you are probably wondering whether anything concrete can emerge from such a notation. Patience please.

Having proved a number of theorems in the arithmetic, GSB introduces variables or unknowns and so creates the Primary Algebra, which is by no means similar to Boolean algebra though it can be interpreted to give Boolean algebra and more by identifying cross with truth and blank with Falsehood.

An expression in the algebra looks like ⌐a⌋ where the value of a is unknown. By deriving a series of nine consequences to which he gives significant names like 'reflexion', 'generation', 'iteration' it is possible to simplify such expressions though they do not always reduce to a known value.

The fireworks now begin. Boolean algebra is based on a set of postulates (ie, unproven assumptions), the exact nature of which set has been the source of much investigation. GSB proceeds to take one such set (Scheffer's Postulates) and prove them all in one page using the algebra. He goes on to demonstrate the interpretation of the algebra for logic. Massively complex syllogisms can be reduced to conclusions with astounding ease when compared to the laborious application of Boolean algebra and de Morgans theorems. At one point it is shown that all of pages 98 to 126 of Whitehead and Russell's 'Principia Mathematica' can be reduced to a single ⌐ .

But the application to logic is a minor incident on the way. The Calculus of Indications, to give the system its full title, is of much greater generality than any logic.

In a breathtaking final chapter GSB introduces the idea of imaginary values by allowing the creation of re-entrant or recursive expressions. From this in a few short pages he produces expressions which demonstrate oscillating values, and can emit 'waves' which propagate through the space containing the expression. In other words, starting from two simple axioms and a simple notation he has produced expressions which can model the behaviour of the physical world of quantum mechanics.

In fact the calculus provides a general theory of forms which does not merely describe different forms but shows how they all emerge from the original form of distinction. Numbers and counting are derivable as interpretations at quite a low level.

At this point, having indicated just how far one could go with the calculus, he stops with what is perhaps my favourite sentence of all: 'This book is not endless, so we have to break it off somewhere. We do so here with the words

and so on.'

This last chapter contains the key to the solution of Boolean equations of the second and higher degree, which is the method the Spencer-Browns used to prove the Four Colour Theorem and which they put to practical use in designing complex switching networks for British Rail. I cannot pretend that I understand it well enough to either explain it here or to use it myself.

That then is a brief and clumsy account of the importance of *Laws of Form*. Why should *PCW* readers be interested? For a whole stack of reasons, the first and best of which is that it is a challenging and exciting book, written with an elegance and wit which is almost extinct in modern science. If you like mental exercise this will stretch you even more than 'Godel, Escher, Bach' and with more immediately usable results.

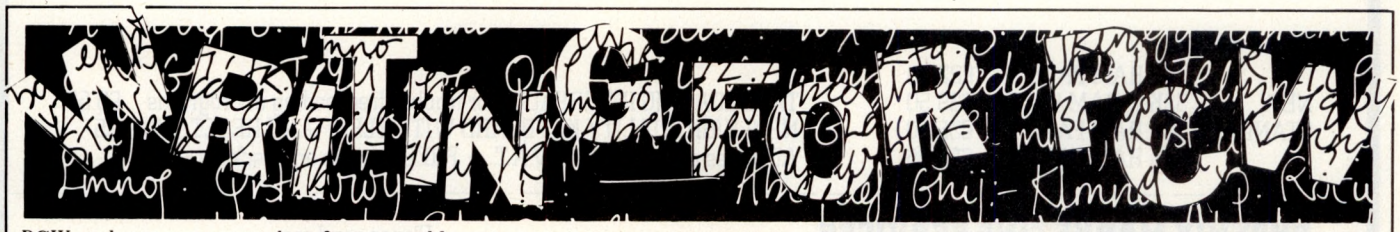
The first project I thought of connected with microcomputing was the obvious one of writing a parser and evaluator to simplify expressions in the calculus. This is not at all an easy task because the calculus relies so heavily on the cross notation, which is simple and beautiful but highly unsuited to character-oriented micro displays. The trouble I had typing those examples above using Wordstar testifies to that. It's probable that you would have to reduce this notation to something rather like the nested brackets in Lisp to make it work; in fact all kinds of half-formed analogies with Lisp enter my head whenever I read the book.

But the really exciting idea which I can't shake off is that of a language which uses the Calculus of Indications in the place of Boolean algebra. Or, to go the whole hog, a processor with this logic implemented in silicon. I'm in way over my head with this sort of talk but everyone nowadays seems to be talking about non-von Neuman architectures as the next generation of machines; is it possible that higher order Boolean logics may have a role to play too?

At any rate I hope I can stimulate a few readers to find the book (it may well be in print here again by now), read it, assimilate it (which will take about eight readings unless you're a lot smarter than me) and just maybe go on to do something amazing as a consequence. It is not as well known as it ought to be and it's nice to have a platform like this to boost it from.

PS. Professor G Spencer-Brown is alive and as far as I know well and living in Cambridge. Should he by any remote chance read *PCW* I'd like to apologise here and now for the roughshod way I've trampled among his ideas.

(*Laws of Form* by G Spencer Brown — E.P. Dutton Paperback, New York 1978.)



PCW welcomes approaches from would-be writers, even those who may never have appeared in print before. In this game it is often those with practical experience who have important things to say so we don't mind too much if their prose is less than perfect. Providing that submissions have a sensible structure and follow a logical sequence, we can take care of the polishing. Here are some tips:

If the article is already written, simply send it in, making sure that your name, address and 'phone number appear on both the article and the covering letter. If you have submitted the same work to other magazines you should tell us — it would be embarrassing (to say the least) if the same article appeared in more than one.

If you have an idea for an article or a series, write us a letter outlining your ideas. A one or two page synopsis giving the proposed structure, sequence and content will give us a sound basis for discussion. Please give us a daytime 'phone number if possible.

If you have nothing specific in mind but feel qualified to conduct case studies, Benchtests or whatever then drop us a line saying what you'd like to do and why you think you're qualified to do it. We're not particularly looking for strings of academic qualifications — experience carries just as much weight.

Dick Pountain is always on the lookout for interesting calculator features and we wouldn't mind seeing one or two readers getting on their soapboxes but remember: even articles such as this need a structure.

Reading *PCW* will give you a good idea of the style we prefer. You may notice that we try to avoid pomposity at one extreme and flippancy at the other (except in 'Chip Chat', that is).

Finally, have a look through back issue indexes and try not to re-invent any wheels. Oh, we almost forgot — *PCW* does pay for all published work.

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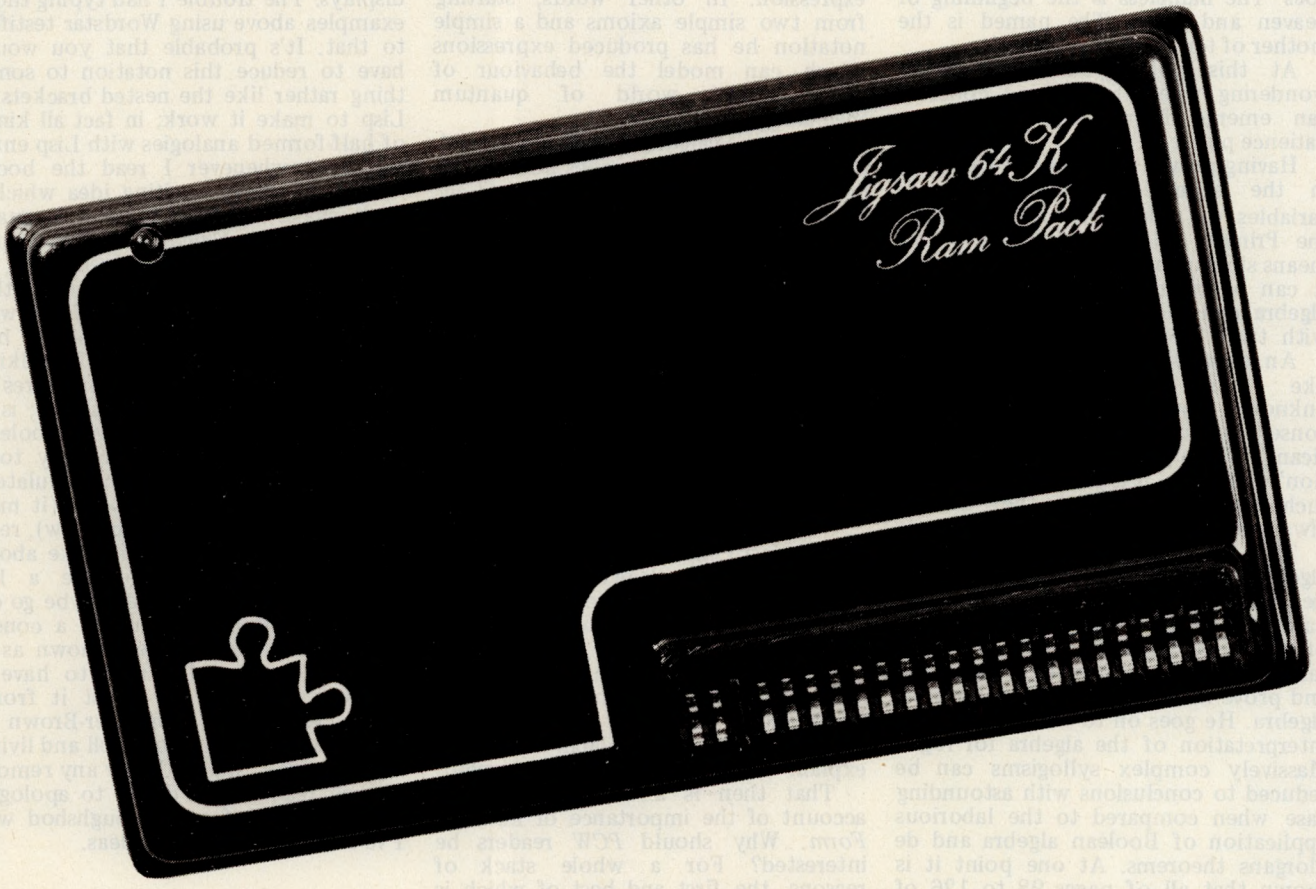

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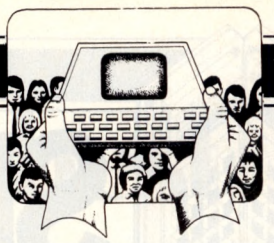

by David Tebbutt

You can always tell when summer comes — the number of ComputerTowns starting up drops to zero. Still, we are getting letters from people willing to have a go in the autumn.

Mr Ravinder Bahra writes from Blackheath to say he'd like to be involved in starting a local 'Town. If you live nearby and would like to help, why not write to him at 218 Shooters Hill Road, SE3?

Nottingham looks as if it might be getting its second local ComputerTown — this time in Eastwood. If you're interested in joining in, give Ted Ryan a call on Langley Mill 65011 or write to him at 15 Queens Square, Eastwood, Nottingham NG16 3BJ.

John Davies writes from the Pinner and District Community Association to say that the ComputerTown project looks like a good idea. John can be contacted at 14 Kingsfield Avenue, N Harrow, Middlesex, H42 6AH.

Not far away, in the London Borough of Brent, John Clarke has located four libraries which would like to start their own 'Towns. Staff from the libraries have been in touch with their Harrow and Rayners Lane counterparts and, Presumably, liked what they saw.

If you're with the people at BFPO58, you will find that Cpl DP Morgan would like to hear from you. He's with 3 Squadron, 9 Signal Regiment and, having recently started a computer club, he's now thinking of a ComputerTown too.

Now for news from existing 'Towns. First, Alan Waring has sent the names of the secretaries of the three ComputerTowns he helped found. If the *PCW* system worked this month, they should now be listed under ComputerTown Contacts at the back of the magazine.

By the time you read this, a very brave man called Frank Fadipe will have organised and run a ComputerTown *Week*(!) with the help and support of the Ruislip library staff. He has managed to persuade all sorts of people to participate, including several local computer firms. Next month I hope to bring you a blow-by-blow account of how things went.

Do you live in Staffordshire? Do you have any influence over decisions of the Library Committee? If the answers are yesses and you think that ComputerTown should be given free space for its meetings could you please whisper in the appropriate ears. At the moment, of course, each meeting costs the organisers money. Since everything about ComputerTowns is voluntary and free, this seems to go against the spirit of the thing.

We're on Prestel! Thanks to the efforts of Vernon Quaintance, Greater London ComputerTowns are being put on at the moment. If all goes well, Vernon hopes to have the space and information to set up all the ComputerTowns. If you'd like to have a look, the pages start at *35748111 # for the moment.

Soon, you will be seeing another name associated with this column. Maggie Burton will be sharing ComputerTown work with me on the grounds that I'm not always available when I should be. Maggie has been working on *PCW* for the last year and is particularly interested in seeeing the ComputerTown Project go well. So, if you have anything to say, you can say it to me or Maggie at one of the addresses in the box below.

We both look forward to hearing from you.

For further details of CTUK! write to: CTUK!, 7 Collins Drive, Eastcote, Middlesex HA4 9EL or 17 St George's Road, London NW11 0LU, remembering to enclose a large SAE (A4 would be fine) for your reply. Please don't try to telephone *PCW* for information because this project is entirely a spare-time activity.

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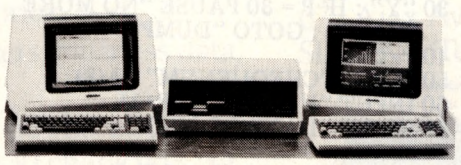

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A GROSS OF FRESH SALES STAFF, PLEASE...

Brushing off the sales talk, Martin muses on micro marketing. . .

'Hello.' He was tall, angular, and his mohair suit had obviously just come from its third visit to the smoothers.

'Hello.' He repeated his greeting as I sat at my desk wondering what other stunning utterance would spring forth to shatter my concentration. It would come in time; it always did.

'My name is Smith, and I was wondering if you might be interested in some office supplies. You know the type of thing. I have a lovely line in carbon paper, glossy one side, matt finish the other. I have 47 different sizes of typewriter ribbons — they're assorted makes as well, so the customer gets the maximum choice, I have little spray cans of Klenelugs, that's the stuff for cleaning telephone handsets. I have a nice line in personal business computers. Then again there is. . .'

'Hold on there, son,' said I. 'I could be interested in a computer. What type is it?'

'Well it's a. . . let me look at the brochure. . . ah, it's a Widget.'

'Is it the 48k version running on CP/M or the original 16k that used that wally operating system that no one ever produced any software for?'

Well, it seemed a fair question for me to ask. After all, I'd read a bit in the magazines about how Widget Computers had completely redesigned its product range so that it could sell some.

He looked perplexed. You can always tell when a sales person is perplexed — his eyes meet in the middle. 'What's software?' he asked. I just asked what the discount was for cash.

Thus ends Scene I, Act I of a play that will almost certainly be performed up and down the country more and more in the future. It is also a precursor to this month's piece and is, for reasons of propriety if nothing else, totally *unconnected* with what follows. What follows is a company's stated intentions. What has already passed is pure fantasy, right?

A few months ago now, Osborne Computers in the UK, the subsidiary of the company that is scaring the financial pants off some others by refusing to roll over and die, held a presss conference. At this affair, its management made a significant announcement. It was significant because of the basic idea involved and also because of the numbers being bandied around to flesh the idea out.

Perhaps not surprisingly, there is some tenuous connection between the subject of the press conference and the foregoing scene. Yes, the press conference was called to talk about sales and marketing, and the way that Osborne Computers intended to set about it in this country.

To put this in perspective, there is need for just a little history. The company, the offspring of Adam Osborne, is less than a year old as a legal entity, with a product that many have defined as 'rubbish' and other 'ong words of a deprecatory nature. The product, the Osborne 1, took run-of-the-mill technology and run-of-the-mill software, put them together in a portable box that had an apparently unusable screen, and sold it at a silly price. The company seems set to exceed $100 million sales in its first year, which is good going for rubbish.

Unlike earlier successful, and unsuccessful, machines, the Osborne was tailored for a specific market. With its built-in facilities, its attendant software and its portability, it was a natural for the professional and business market.

Having now dispensed with the history, we move back to the point of the press conference. How will Osborne in the UK move to meet the potential sales demand it expects to find — nay, not only expects but has sales projections to justify the expectation?

The company's objective, as stated at the press conference, is simple. It plans to have about 60 retail outlets around

Illustration by Will Hill

the country by the end of the year(ish). For the type of product the Osborne 1 is — a directly business-oriented machine despite its low cost — the general consensus of opinion suggests that this is a good number of outlets with which to sensibly cover the country.

To this will be added a number of OEM-oriented outfits, the type of company that buys the machine as an engine for its own 'unique' software products..

On top of this there will be a number of freelance sales staff, recruited to hit the major sales accounts. By this the company means the now well-understood market for multiple sales of machines into large companies. OK, so the company is looking for half a dozen such hot sales persons, maybe 10 at the most, certainly to begin with.

Well, no. It plans (or planned, for it will now be in the past tense according to the announcement) to appoint up to 200 by September (and that is the September that has just gone, not the one next year).

It was a great shame that the company felt impelled to put figures to the basic idea, for it made the idea nonsense when in fact it is completely sound. It made it nonsense because one set of figures could be compared with others, as will be seen later.

First of all, the idea. In theory it is just right. A machine like the Osborne 1 is geared specifically for the type of market filled with the managements and executives of the large companies of this world. Such large companies often have central buying policies so that the best prices can be obtained. They are also normally tough sales nuts to crack. It is an ideal area for professional sales persons that know their way round both the product and the marketplace.

But it is a market that does not need too many of them. Indeed, it is arguable that there are not that many of them to start with. It requires a special blend of skills in — sales, marketing, and the technology of hardware and software to sell micros to such people. It is also a marketplace where sales take time. Months, even years, can go by before the 'big order' comes over the hill.

Now, Osborne want to have appointed 200 by the time you read this. Yet at the same time it is saying it is predicting a UK sales volume of 1,000 units per month by the end of the year. With our calculators at the ready we can see that, on average each person will sell five units a month, which means that with around 30 percent discount, they could expect to gross around £1800-£2000 a month. This is just about enough to run a single person small business with such overheads as a car and money-in-front stock purchasing. It would barely cover the cost of in-depth customer support however.

Ah, yes. Support. Now where would support come from? This according to Osborne, would come from the dealer network.

Oh dear, we had forgotten the dealers, hadn't we, and there will be around 60 of them. That means that each 'outlet' will sell under four units a month, on average, which is hardly enough to make a living. But there is a grey area here, for why should the dealers provide support for apparent rivals? The answer, according to Osborne, is that the sales people will be selling for the dealers under arrangements that they strike between them.

In essence, what this would surely mean is that the salespersons' operating margin would be less than 30 percent — probably considerably less. Each would have to sell much more to stay in business, even though Osborne's predictions for the market don't indicate it.

The net result of the idea is right — in theory. There is a big market in the large companies, and it is a market that the microcomputer industry is trying to come to terms with. Sales people out on the road is a definite starter as a solution, even if it would have been anathema as an idea just a couple of years ago.

The figures as published by Osborne at its press conference, however, do not seem to indicate the best way to go about it. The purchasers, certainly in the short term, will probably love it. It is a recipe for virtually every form of cut-throat sales tactic that the sales trade has ever invented (for cut-throat the potential puchaser can normally read cut-price) for the sales people will be out to grind each other into the ground to maintain some level of business.

Either that or the 'sales people' will be as outlined in Act I, Scene I. Computers will just be something else they have on the van, along with the carbon paper, used cars, and a night on the tiles with Auntie Vera.

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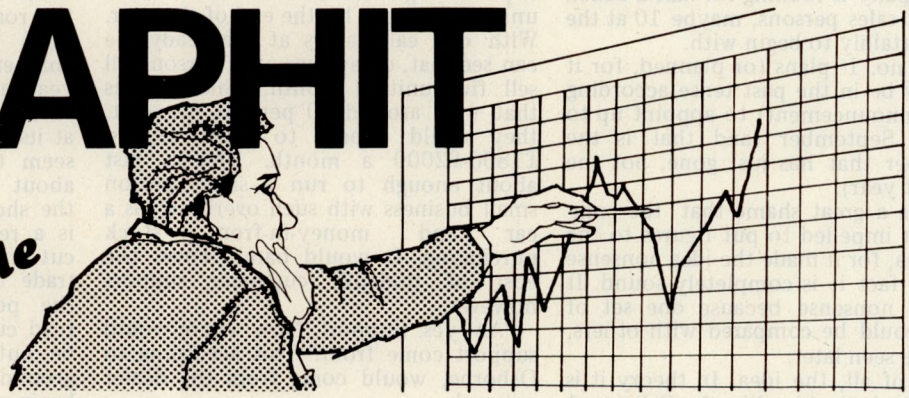

Visicalc compatible

There are a number of programs which will portray graphs on a Microcomputer. Indeed, we stock two already, Graph Plotter and Plotter. Graphit, however, is the ultimate of such programs. It has been written solely for displaying graphs. It is compatible with Visicalc DIF files. Hence such a file constructed with Visicalc can be fed into Graphit and a graph display obtained. Users may also, however, insert data directly from the keyboard into Graphit. This data may then be fed into Visicalc for further processing.

Every function that we can think of that would be of use to a person requiring a graph has been included in Graphit. Labels may of course be used and these may be transposed from the side to the bottom or vice versa at any time. A great deal of work has been put into manipulation of the display in the sense of magnification, or changing the scale. The program will itself first of all calculate an appropriate scale but thereafter this may be altered in almost any way. Thus a small section of the graph may be made to occupy the whole of the screen. Alternatively a large proportion, or all, of the data may be displayed at once. In other words, the program has complete flexibility of display of the graph.

Scrolling is supported in either a latitudinal or longitudinal direction and by one column or by a complete page. If, for instance, the months for one year are set up along the bottom of the screen with sales figures up the side, the user can move along in either direction from month to month or jump six months at a time and show the whole page — the display facilities are almost endless. And display, when you come to think of it, is what a graph is all about.

The graph as shown on the screen may be printed out to a line printer or the raw data on its own can be printed out. The axis can be changed at any time so that if, as in the example mentioned above, we have the months along the bottom of the screen, by one simple keystroke they can be made to go up the side, and the sales figures along the bottom, with the graph changing accordingly of course.

At any time the zig-zag display can be changed for the step and of course vice versa.

Perhaps the most important feature, has been left until last. Graphit was specifically commissioned and the specification called for ease of use, as the prime requirement. Not only, therefore, is a comprehensive manual supplied, but also at almost any time while using the program the H key can be pressed for help, whereupon all of the available commands are displayed. Graph programs in the past have rather suffered from being included in other software. This one concentrates entirely on drawing graphs and gains a lot thereby. Available on disk only, compatible with the Genie I and II and the original Genie, together with the Tandy Models I and III.

(Visicalc is a Registered Trademark of the Visi Corp.)

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Established at last
The system has a new release, Version IV, and already it's very popular. It's fitted and running on the latest microcomputers being delivered by IBM, Apple, ITT, Texas Instruments, Philips, Xerox, DEC, Tandy, Northstar, Altos, Osborne, Superbrain and others.

The same friendly face
On each of these machines, the user is presented with the same friendly face, the same easy-to-use operating system, the same p-machine code. So the same programs run without recompilation. And it helps you write very large programs too -with lots of separately constructed pieces, programs can be much larger than the memory of your machine.

What you get
The UCSD p-System gives you a complete programming development system which lets you write programs in UCSD Pascal. You get a screen editor, a line oriented editor, a compiler for UCSD Pascal, a native code assembler, a linker, a debugger, a filer and a host of utilities - such as disk recovery.

Other machines
In addition to the systems listed in the coupon below, fully fitted systems can also be obtained on request for the following machines - IBM Personal Computer, TRS80 model II or III, Superbrain, Altos 8000, LSI 11, Xerox 820.

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	Z80 Adaptable System (includes User Manual, Installation Guide, Internal Architecture Guide) Requires fitting & disk conversion	£455	
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Be honest. When was the last time you could tear yourself away from the tedium of the office, and fly off to another part of the world to secure a new order, investigate a new business opportunity, or simply enjoy yourself? If you've become your own worst paid executive working all hours on paperwork, book-keeping or general administration, the chances are it's longer than you care to remember.

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The package consists of a powerful, compact and reliable microcomputer, with a full-size keyboard, built-in screen, 64K of RAM, and dual disk drives as standard. Also included is a quality matrix printer giving a choice of 80 or 136 characters per line, three different type-faces, and the option of using roll paper, single sheets or even multiple copies. Relevant software programmes for the Genie III have been specially produced by TABS, one of Britain's largest suppliers of business software packages, and the complete system is covered by a special one-year maintenance contract . . . all for around £3,250.

EXPERT INSTALLATION

If by now all this sounds too good to be true, come and see for yourself. You can meet the Genie III at one of the specially selected SUPERDEALERS, whose technical expertise and experience in the fields of installation, software and maintenance is proven. It could be the first step towards a more successful future for you and your business.

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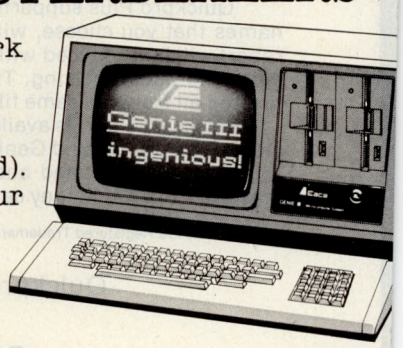

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which should please physicists. The time to run Benchmark 8 is slower than average but bear in mind the above-average precision.

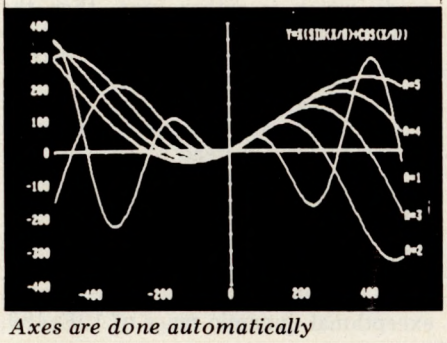
All entries to the computer are via an excellent full-screen editor which allows direct calculations as well as program lines to be edited; using ROLL you can edit and re-enter entries made 50 lines ago. A fine feature is that there is no READY prompt, just the cursor, so you don't get that infuriating syntax error if you CR through the prompt which most full screen editors give. AUTO, RENUM and DELete are all provided, plus a fine selection of debugging aids, most of which have their own keys. PAUSE stops execution until CONT is pressed. STEP single steps through a program. TR/NORMAL toggles trace mode, which can display not only line numbers but also selected or all variable values. LIST lists the whole program and displays the number of free bytes at the end. The remarkable thing is that most of the keyboard is active while a program is running; there is no need to hit PAUSE in most cases. You can for instance go straight into TRACE during a program run. Most keys when hit will pause execution; some, like KEY LABEL which displays the function key assignments, leave the program running and just do their thing.

Full syntax checking is performed as a Basic line is entered. Error messages are descriptive, not just numbers, and the cursor is positioned over the error. Programs should normally be initialised with the INIT key before running; this performs semantic checking (eg, FOR without NEXT, GOTO nonexistent line) as well as erasing calculator variables and allocating space for program variables. The latter is valuable if you're in any danger of running out of space and is not performed by RUN.

The editor keeps all spaces inserted between the line number and the first statement so that indentation can be used for readability; it also turns all reserved words into uppercase, however entered.

All considered this editor/terminal combination comes closer to the ideal I outlined in August's Braindump than any I have seen to date, and the speed with which you can write code is significantly improved.

The Basic itself is not Microsoft based but close to the extended ANSI standard. For instance, string manipulation is by substring notation — eg, STRING$ [n,m] rather than MID$, LEFT$ and RIGHT$ functions. Strings must be dimensioned if longer than the default length of 18. 31 character variable names, all significant, are recognised and lower and uppercase are distinguished. REAL (12 digit, 12 byte), SHORT (5 digit, 8 byte) and INTEGER (5 digit, 7 byte) can be declared defaulting to REAL.



Axes are done automatically

The set of functions provided is more extensive than most Basics, including MIN,MAX,FLOOR and CEIL, INFinity and EPSilon (the largest and smallest machine numbers) in addition to the usual trig and logs.

A powerful aid to program readability is the provision of GOTO and GOSUB < label > instead of a line number; the labels follow the rules for variable names so you can say GOSUB Compute-Area or GOTO INPUTROUTINE. Remarks are prefixed with ! and may be added to the end of line; the editor preserves spaces between the last statement and ! so you can line them up nicely. A single line IF. . . THEN. . . ELSE and single or multi-line user defined functions are the only offerings made towards structured programs. Nevertheless, the proper use of all these features plus indentation makes for much more readable than average programs.

A powerful PRINT USING (and DISPLAY USING) statement is provided which uses IMAGE strings to control the output format of numbers. Long programs can be segmented and loaded from disk using CHAIN. Any variables which need to be passed between segments are declared as COMmon; the variable names need not be the same, only their order in the declaration list being significant.

Three types of interrupt can be handled by Basic. ON TIMER # allows one of three internal timers to cause program branching. ON KEY # causes programs to branch by pressing one of the function keys; it is also used in command mode to assign strings to these keys. When the computer is switched on they are assigned 14 Basic keywords (seven shifted), and these are not affected by any assignments made by a program, so there are effectively 28 functions. Finally ON ERROR /OFF ERROR permits error recovery. While on this subject, certain maths errors can be trapped by Basic itself — eg, underflow, overflow or division by zero. A default value (eg, INF or 99999999999999E+499) is taken, a warning is issued and execution is not halted. This condition can be overridden if required by DEFAULT OFF, in which case a normal error occurs.

The HP-86 graphics deserve a benchtest to themselves. They are lifted straight out of the 9800 series of benchtop 'microminis' and include the most powerful graph-plotting facilities to be found on a personal computer.

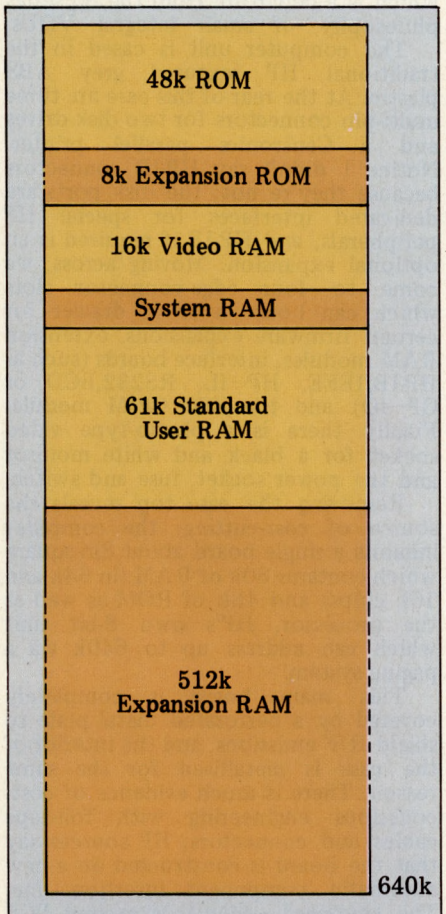
Anything which is displayed on the screen can be just as easily sent to a multipen plotter such as the 7049 by declaring PLOTTER IS and its device address.

Characters can be freely mixed with graphics on the high-res screen by incorporating the text into LABEL statements. Such characters can be printed in any size via the CSIZE statement which can also italicise and condense the letters. Labels can also be printed in any orientation using LDIR < angle >.

Any portion of the physical screen or plotter can be selected for plotting by LIMIT; within this area the LOCATE statement sets up a plotting area and scales it in Graphic Units so that there are always 100 GUs along the horizontal axis. These units can be overridden by User Units using the SCALE statement: eg, if you want to plot x from −200 to 200 and y from 50 to 300 then SCALE − 200, 200, 50, 300 does the trick, automatically converting to graphic units. MSCALE sets up a scale in millimetres for drawing office applications. Axes or grids can be drawn by the machine, marked with appropriate ticks using AXES or GRID. They can even be automatically labelled to the required number of decimal places by LAXES. a selected part of a graph can be cut out using CLIP and then blown up by changing the LOCATE parameters. Making certain LOCATE parameters negative will invert or reflect a plot while leaving the labels right way up.

These plotting commands are much harder to describe than they are to use. Suffice it to say that it is extremely easy to produce a graph with nicely labelled axes (with major and minor ticks) labelled with lettering following the slope of the graph and all automatically scaled so that no crashes occur due to plotting out of limits; and all this with about six lines of code.

Actual plotting of points is performed by PLOT in absolute screen coordinates, by IPLOT relative to the last point plotted or by RPLOT relative to a local origin which is moved by any pen moving command except RPLOT itself. All of these can take an optional para-



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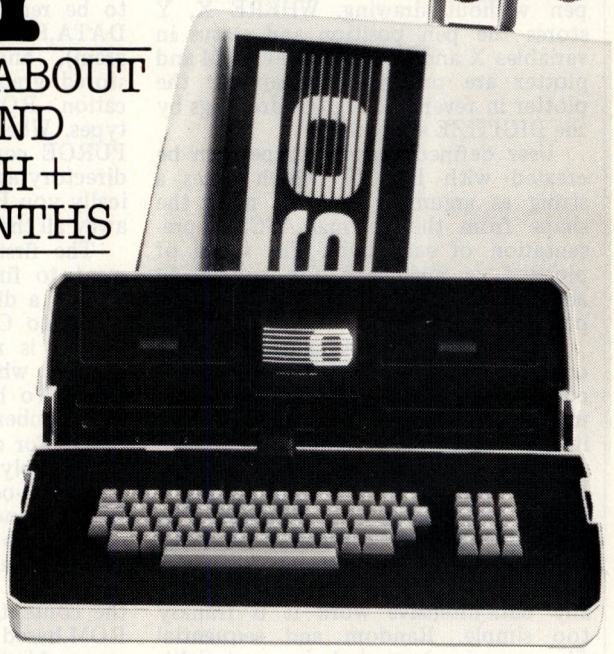
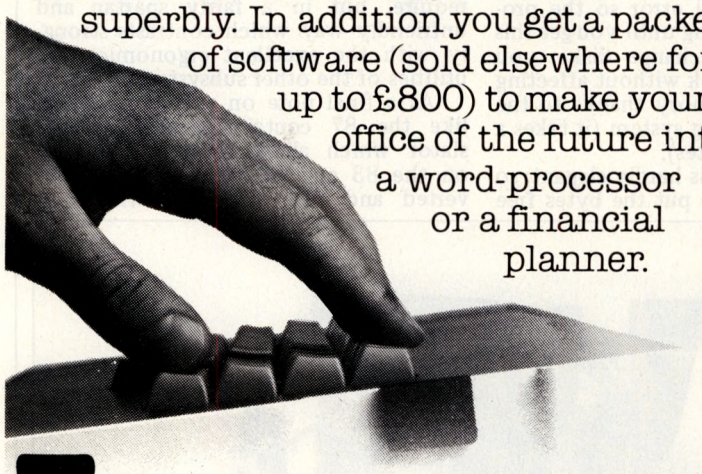
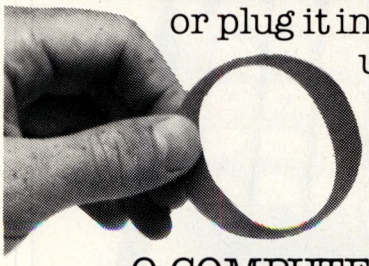


1 The heart of this office of the future is the powerful new Osborne 1 portable computer, with 64k memory, two disc drives and a built-in monitor. The Osborne is linked to an Olivetti Praxis 30 11cps daisy-wheel printer/typewriter for printing your work superbly. In addition you get a packet of software (sold elsewhere for up to £800) to make your office of the future into a word-processor or a financial planner.



2 Your Osborne and Praxis are a remarkable combination. The machines are so portable you can carry them both home instead of working late. Plug them together slip the Wordstar/Mailmerge disc into the drive and you have a word-processor as good as costly dedicated systems. Change discs for Supercalc and you have the power of a dozen clerks for your budgets. Then Osborne types your work perfectly on Praxis.

3 The Olivetti Praxis 30 is a new style electronic typewriter with its own memory, automatic erase, and a double keyboard which gives you 14 extra characters. Use your Praxis on its own as a prestige easy-to-use typewriter, or plug it into your Osborne and use it as a high quality computer printer.



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BENCHTEST PERSONAL COMPUTER

Photography by John Mason

AFFORDABLE HP!

Dick Pountain checks out the HP-86, a lower cost addition to HP's 80 series of personal computers.

There is much excitement in the hi-tech halls of Hewlett Packard about a new product, the HP-86. Not because it represents any great departure in hardware terms from the established 80 series, but because for the first time HP has a personal computer which is priced to compete in the mainstream of the market place. HP has always been associated with high-priced high-quality products which have been bought largely by the scientific, engineering and other professional communities on reputation rather than cost considerations. The launch of the HP-125 business/management micro in 1981 broke new ground in using a non-HP produced processor (the Z80) and a non-HP operating system (CP/M) as an acknowledgement that these represent the realities of the current business micro market, but

it is still priced well above the industry average and must sell on reputation and its advanced ergonomic features.

The HP-86 takes a further step toward the deep end. It is nominally part of the 80 series of laboratory and professional microcomputers but it can be expanded with a Z80 module to run CP/M. Most significantly, though, it is priced at a level which competes directly with Apple III and various other machines in the middle range at around £3000 for a 64k, twin disk system with printer. This is still someway above the £2000 typical of the keenest CP/M systems, but the 86 does offer graphics facilities which are either unobtainable or extremely costly on such machines. It demonstrates a new commitment by HP to compete in the hurly-burly of the volume micro-market, and to achieve this by up-to-date production engineering techniques. The design features of the 86 are closely based on the HP-87 introduced earlier this year, and the two machines are fully software compatible; the 86 is at least £1000 cheaper for a comparable system due to cost cutting exercises.

Hardware

The 86 is a 'separates' system, comprising keyboard/processor console, which is a departure from the 80 series philosophy of small integral VDUs.

The computer unit is cased in the traditional HP textured grey ABS plastic. At the rear of this case are three multi-pin connectors for two disk drives and a Centronics parallel printer. Notice I didn't say HP-IB connectors because they're not: the disk ports are dedicated interfaces for special HP peripherals, and HP-IB if required is an optional expansion. Moving across, we come to four edge-connector slots which can house a ROM drawer for certain firmware expansions, extension RAM modules, interface boards (such as HP-IB/IEEE, HP—IL, RS232,BCD or GP—IO) and the Z80 CP/M module. Finally there is a phono-type video socket for a black and white monitor and the power socket, fuse and switch.

Removing the case top reveals the source of cost-cutting: the computer inhabits a single board about 8in square which contains 80k of RAM (in 64k and 16k chips) and 48k of ROM as well as the processor, HP's own 8-bit unit which can address up to 640k via a paging system.

This main board is completely covered by a perforated metal plate to shield R/F emissions, and the interior of the case is metallised for the same reason. There is much evidence of cost-conscious engineering with foil-tape cables and connectors; HP sources say that the board is constructed on a new automatic component insertion line. The keyboard occupies a second PCB and the power supply has a third small one. The key switches are robust sealed units, but it is slightly worrying that there is no sort of backing plate: you can see the underlying PCB through the gaps between keys and therefore also drop paperclips or coffee right into the works (the PCB is heavily lacquered which is some comfort).

The keyboard has four main areas: a qwerty alphanumeric section, a numeric keypad, a screen control pad and seven programmable function keys with their associated KEY LABEL key. The main keyboard area contains some special keys like RUN, LIST, TRACE/NORMAL, CONT, PAUSE and STEP which are used during editing and will be discussed more under software. The numeric keypad, to my delight, has *ALL* the arithmetic functions duplicated on it as well as the unshifted) and (symbols which makes it into a self-contained, one-handed calculator. It also has a RSLT key which recalls the result of the last performed calculation to the display. Keys are provided to clear the screen, clear to the end or to the beginning of the line, insert and delete characters (BACKSPACE is a destructive backspace while —CHAR removes the character under the cursor; it is good to have both). All keys repeat after a short depression at a brisk rate. There is no TAB key — one or more of the function keys being used for this function if required.

The enter key is called END LINE which I'll grant is a better name than RETURN or CR as this function is not merely carriage return but carriage return/line feed; it's a pity though that everyone can't agree to call it NEW-LINE since between Clive Sinclair and the ANSI standard this seems likely to triumph eventually.

RESET performs a hardware reset without clearing programs in RAM. The CTRL key does not use the normal ^ representation for control characters instead the first 32 ASCII codes appear on the screen as Greek, Scandinavian and assorted graphics characters including the £ sign.

The ROLL key reveals an interesting facility: the 86's screen memory normally holds 54 lines of text by 80 columns, of which either 24 or 16 lines are displayed (selected by the PAGESIZE command). ROLL and its shift allow you to scroll this window up or down through the text eventually returning to the starting point as if the text were written on a cylinder. This means you can, for instance, scroll upwards through a program listing. In fact the screen memory is shared between text and hires graphics. The default condition is 54 lines of text and 400x240 graphics and you can switch manually between text and graphics screens with the A/G key or in a program by the ALPHA and GRAPH statements. If, however, you declare ALPHALL then the whole of screen memory is given over to text (204 lines); similarly GRAPHALL gives 544x240 pixels of graphics. In GRAPHALL mode though it is not possible to enter any text at all to the screen; you can re-route it to the printer or a disk file if you wish.

I was deeply impressed by the ergonomics and the terminal facilities of this keyboard which are the best of any machine I have used; program entry and editing on it are a pleasure.

The monitor supplied was a 12in green phosphor unit made in Japan for HP. It displays only average sharpness and steadiness, though it is by no means bad; it does not have a green filter over the screen and as a result contrast in well-lit rooms is not as good as it could be. Interestingly it has video and audio inputs and outputs on its backplate, though the 86 makes use only of the video input, having its bleeper in the console section. Many other monitors would be suitable for use with the 86.

The HP 9130A disk drive is specially designed for the 86. It is much smaller than previous HP 5in drives in a neatly styled plastic case rather reminiscent of the Apple III drive. Like the latter it takes its power from the computer so that, thankfully, no extra power cord is needed. The firmware to drive two of these is contained in ROM in the 86 as standard (as is the printer driver for a dot-matrix printer). Each drive holds 270k formatted and (under Basic) has the user selectable skew-factor feature introduced by the HP-125. The disk format is compatible with the HP-87 (as are most features of the 86).

Software

The HP-86 comes with an extended graphics Basic in ROM. On power up the machine goes through self-test routines and then deposits you in Basic, without any sort of sign on message, merely the square non-flashing cursor. Of the 80k, 16k is used as video memory and a little is pinched by the operating system leaving 61k for the user on switching on — which is twice as much as most disk-based Basics leave you; it is in fact more than you will get on a 128k Sirius or Apple III with Basic loaded. In this state the machine is in calculator mode which is rather more than the usual Basic command mode. Calculations of any complexity can be carried out directly without the need to use PRINT. Variables may be assigned values which are available to programs by using CONT instead of RUN as well as to direct calculations. Because of the rather special way the keyboard works (see later) it is possible to stop a program, perform manual calculations and pass the results to the restarted program.

Arithmetic is to 12 digits with the exceptional dynamic range of 10E±499,

HEWLETT PACKARD HP86

meter which controls the raising or lifting of the pen. Lines are produced by DRAW (a relatively weak version which can only take two points as arguments; you can't draw a polygon with one statement) and MOVE, which moves the pen without drawing. WHERE X, Y stores the pen position and status in variables X and Y. If a plotter ROM and plotter are present you can use the plotter in reverse to digitise drawings by the DIGITIZE statement.

User defined graphic shapes can be created with BPLOT, which takes a string as argument and bit maps the shape from the decimal ASCII representation of each byte. The speed of plotting is sufficient for convincing animation to be done by MOVEing the pen between BPLOTs.

It is hardly surprising that the 86 contains 48k of ROM when you consider the amount of matrix arithmetic and such which must be contained in this remarkable graphics package.

If graphics are the strongest point of the 86 then the disk operating system is definitely its weakest. The publicity material describes 'easy I/O' facilities as an advantage; for some applications this may be true but for any data-intensive work it is frankly too simple. Random and sequential files are implemented in a straightforward way using CREATE to allocate disk space (the number and size of records is specified), ASSIGN# to allocate a file buffer and open the file. Data is transferred by PRINT# and READ#. Data of different types can be mixed in a file and the TYP function will return the type of the next record to be read. The allowed file types are DATA,PROGram,BPGM(binary program), and GRAF which contains stored graphics screens. Certain application ROMs can create other file types. When files are deleted using the PURGE command they remain in the directory as file type NULL and periodically you PACK the disk which sweeps away all these NULL files.

The first problem comes when you want to find out how much space is left on a disk. There is no utility equivalent to CP/M's STAT and the information is not given in the directory heading, which merely gives the volume name. To be sure, the directory gives the number of records and bytes per record for each file but I defy anyone to multiply and total these for a disk with 100-odd files. Fortunately DISK FULL is not a fatal error so the procedure is to keep going until you get this message and then change disks; you can format a new disk without affecting the contents of memory thanks to the ROM based operating system (it takes a reasonable two minutes).

This works but it is hardly elegant; so much better to have put the bytes free in the directory heading.

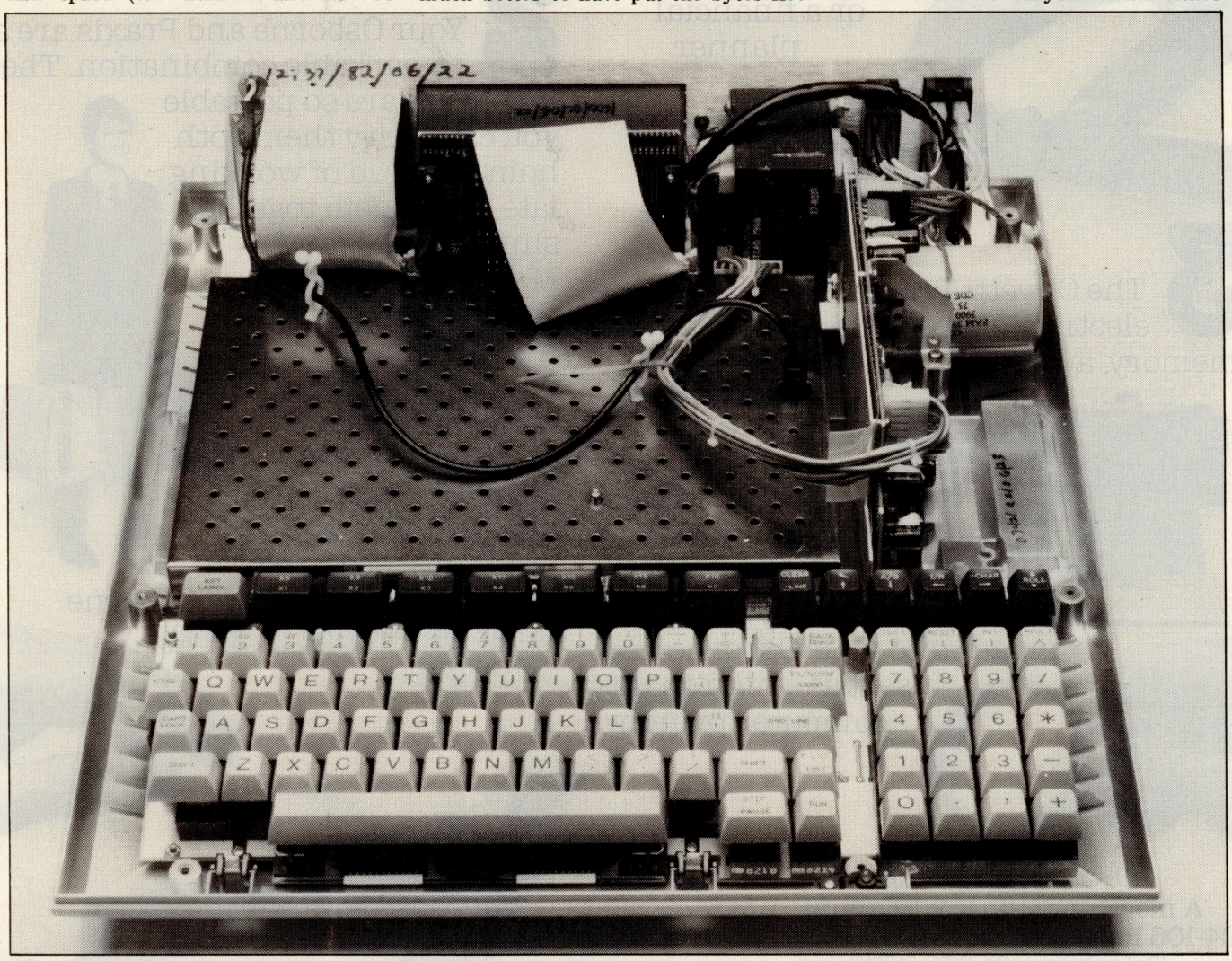
The next problem is that the command to copy files or whole disks only works with two drives. With only one supplied I couldn't backup any disks as the COPY command doesn't allow you to change disk; it searches for the destination volume and gives an error when it only finds the source. Again it would have been quite easy to have COPY prompt for number of drives and pause if necessary to allow a change. This is a real pity as the drives are not cheap and a single drive system would be very suitable for a lot of lab and workshop applications.

COPY doesn't allow wildcard filenames either; you can only copy single files or whole disks. In the latter case, the files are added to any on the destination disk rather than overwriting them.

The final irritant is that the operating system gives no prompt to signal successful completion of a program LOAD or STORE: the red light on the drive is the only sign that anything has happened; the cursor merely sits blandly on the screen doing nothing.

The operating system works perfectly well and will do most things you require, but in a fairly spartan and unfriendly way which contrasts strongly with the excellent ergonomics and utilities of the other subsystems.

As a final note on software, the 86 like the 87 contains a built-in translator which allows programs written on the 83 and 85 models to be converted and run. Anyone with either



The perforated plate is a Faraday cage to trap RF emissions

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of these models can thus upgrade without losing the use of their program library. It will not run 85 ROM software however.

Expansion and potential use

The HP-86 is capable of addressing a prodigious amount of RAM. Expansion modules can be had in 32,64 and 128k sizes and may be combined to a total of 576k user memory.

Similarly the ROM may be expanded by fitting a ROM drawer into one of the rear sockets which can hold six ROMs. The most likely first candidate is the Plotter ROM followed closely by the I/O ROM which adds routines to the Basic to handle instrument and control applications. An assembler is also available in ROM and an EPROM programmer.

A module containing a Z80 can be fitted to allow the 86 to run CP/M. This module totally disconnects the 86 processor and ROM, effectively turning it into a new computer; most of the advanced editing/debugging aids are disabled as are the function keys and the calculator mode. File formats are incompatible so there can be no transfer of data between HP Basic and CP/M. The attraction of CP/M is nevertheless strong for two reasons: Wordstar and Visicalc-PLUS, both of which are offered. One would treat the 86 as two different computers and use CP/M purely for word processing and spread sheet work. The Visicalc is a greatly enhanced version with extra maths and graphics capability, and with the full RAM expansion it can handle an enormous worksheet.

HP intends to implement the UCSD p-system in the near future and to offer the Pascal and Fortran, though I have no details of how it will be done (ie, will it be under CP/M?)

On the hardware side, an HP-IB module can be had which opens the 86 up to all HP's plotters,printers and instruments as well as to their other disk drives, 5in,8in and winchester. A very large number of these can be accommodated on HP-IB (40 5in drives or five winchesters!) if you can afford them.

The new HP-IL loop interface is also available to link the 86 to HP-41C calculators, tape drives, timers or other series 80 computers for data collection.

Any Centronics-type parallel printer can be used on the dedicated 86 printer port, though HP has simultaneously released a parallel version of its 82905 dot-matrix printer which can do graphics.

A 9in monitor is offered as an alternative to the 12in one tested. The library of ROM software for the 87 and 86 is now quite large though inevitably heavily biased toward scientific, statistical and engineering applications.

Who would use the 86? Despite HP's intention that this should be seen as a general-purpose computer it still has most appeal to the traditional HP customer in the laboratory and design office. The graph-plotting capabilities are so powerful that any application which doesn't require them is rather a waste of its talents. That's not to say that there aren't many management and educational applications which could benefit from these features. Nevertheless, I suspect that the 86 will mainly go into those regions of the scientific and engineering market which have been invaded by Apple and PET because hitherto HP was considered to be beyond the budget.

Does it make sense as a pure CP/M machine? You could certainly use it as a small business machine but there are plenty of cheaper CP/M machines to be had; moreover not to use the HP Basic would be rather like putting a Steinway in the public bar, — nice but rather extravagant.

In its ROM-based mode the 86 is very much a programmer's machine; everything has been done to make life pleasant for the owner who writes his own medium-sized but complex programs. As a personal computer on the lab bench it represents good value, since a single drive system could be had for around £2300 if you bought a cheaper monitor and an Epson MX-80 printer. It would be nice if they did something about the COPY command to facilitate this kind of use. There is plenty of scope for upward expansion from such a base system too.

It goes without saying that the 86 is not for hobbyists unless they be wealthy amateurs of science.

Documentation

The manual I was supplied with was for the HP-87 but since the only material difference is the shape of the screen (even the number of dots is the same) it will require only minor alterations. It is a large ring binder which has a first section of owner's information and abbreviated instructions for getting started, a section on HP-IB operations and then the 300-page Operating and Basic Programming Manual. All are written to the customary HP Standard; clear, readable and comprehensive with the exception that as normal there is no hardware information, not even a memory map. HP definitely does not approve of users wandering round through the innards.

The Basic manual has extensive tables at the end of key codes, expanded explanations of the 131 error messages and a list of the functions, commands and statements with syntax for quick reference. A full index is provided at the end.

As usual it is difficult to fault HP's documentation; maybe it could be done better but nobody does.

Prices

HP—86 Console		£1251.47
Monitor 9"		£205.67
12"		£226.59
Disk Drive 9130A		£592.62
Printer 82905B		£589.13
Expansion RAM	32k	£205.67
	64k	£313.74
	128k	£544.27
CP/M Module		£345.11
ROM Drawer		£31.00
ROM Module Plotter		£101.90
I/O		£205.67
Assembler		£205.67
HB—IB Interface or RS232		£275.39

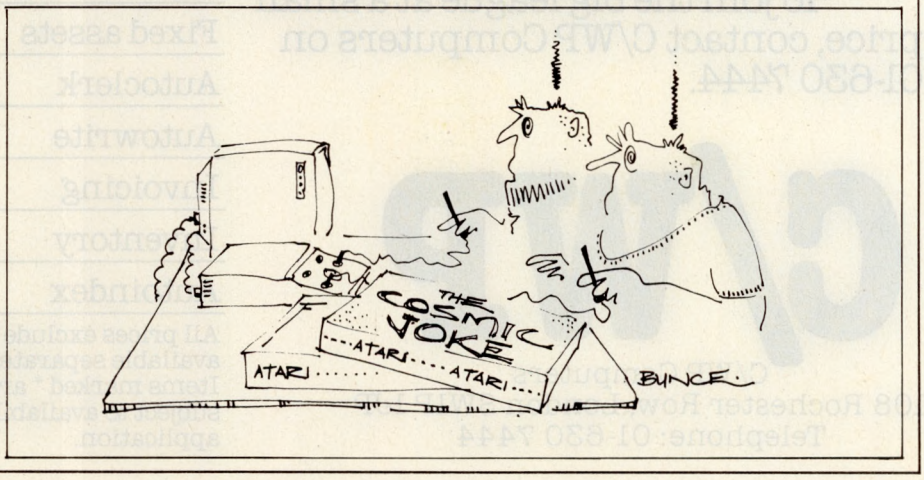
Service contracts are available, price not known.

Conclusion

Though it is still by no means a budget machine, the HP—86 represents a dramatic saving over the HP—87 and 85. A similarly configured twin disk system will be at least £1200 cheaper while having the same functionality. The disk drives, though much cheaper than previous HP models are still too expensive by half and bump up the system cost. With a bit of shopping around a single disk system could be built for around £2300 with a printer, though backing up data would be inconvenient. At these sort of prices it competes with Apple III, Sirius, IBM, Sharp MZ—80B and the larger Commodores as a laboratory tool. Its plotting facilities and arithmetic are very much more advanced than any of these machines in their standard forms, though it is less flexible in the range of languages available at present. It is nevertheless a welcome sign that HP is ready to do battle in the volume personal computer market and should keep the other manufacturers on their toes.

Benchmark timings

BM1	3.0	
BM2	5.2	
BM3	19.4	*All timings in*
BM4	18.8	*seconds. For an*
BM5	20.4	*explanation of the*
BM6	36.5	*Benchmark tests see*
BM7	56.5	PCW *Vol 4, No 11,*
BM8	13.4	*November 1981.*



POSITRON 9000

BENCHTEST
MULTI-USER SYSTEM

Roger Oliver and Chris Sadler test a new British colour micro

The 6809 processor is popular among assembler programmers because of its simplicity and power. It hasn't appeared in many microcomputer systems, though, as its announcement post-dated major software development on other processors (the Z80 and 6502). But it has a loyal following and some high-level software.

Positron is a Manchester-based company which has designed a flexible system (the 9000) around its favourite chip. For software it chose OS-9, a multitasking operating system from American software house Microware.

Hardware

Picture an Apple-style casing (ie, white plastic with an inclined front section containing the keyboard and a flat top to support the monitor), double the length and breadth to 61 x 58 x 10 cms, and you've got an idea of the main module of the Positron 9000 review system. The keyboard is grouped into four 'pads' — a 61-key qwerty section, an 8-key 'graphics encoding' pad, a 12-key 'video attributes' pad and a standard numeric keypad. The qwerty keypad is designed for Viewdata rather than ASCII input, which means there are fractions and left and right arrows rather than brackets, braces and the backslash. The non-printing keys (distinguishable by being a lighter shade of grey) include ESC (end-of-file in OS-9), SHIFT LOCK and CAPS LOCK, REPEAT, DEL and a set of cursor control keys. At present only the back-arrow is decoded (it functions as a BACKSPACE). The other arrows and a red BREAK key are not yet decoded. The keyboard is robust, requiring very firm keystrokes to operate, but the main criticism is that DEL (which deletes the current line) is directly beneath RETURN — which can be a bit disconcerting for the habitual mis-typist.

The video attributes keypad has eight colour keys which are used to select the current colour (in alpha or graphics mode) and four which select display attributes — flashing/steady, normal/double height characters, background and graphics status. When in graphics mode, blocks in the Viewdata 2x3 matrix at the current character position can be toggled on or off with the corresponding keys in the 2x3 key matrix on the graphics encoding pad.

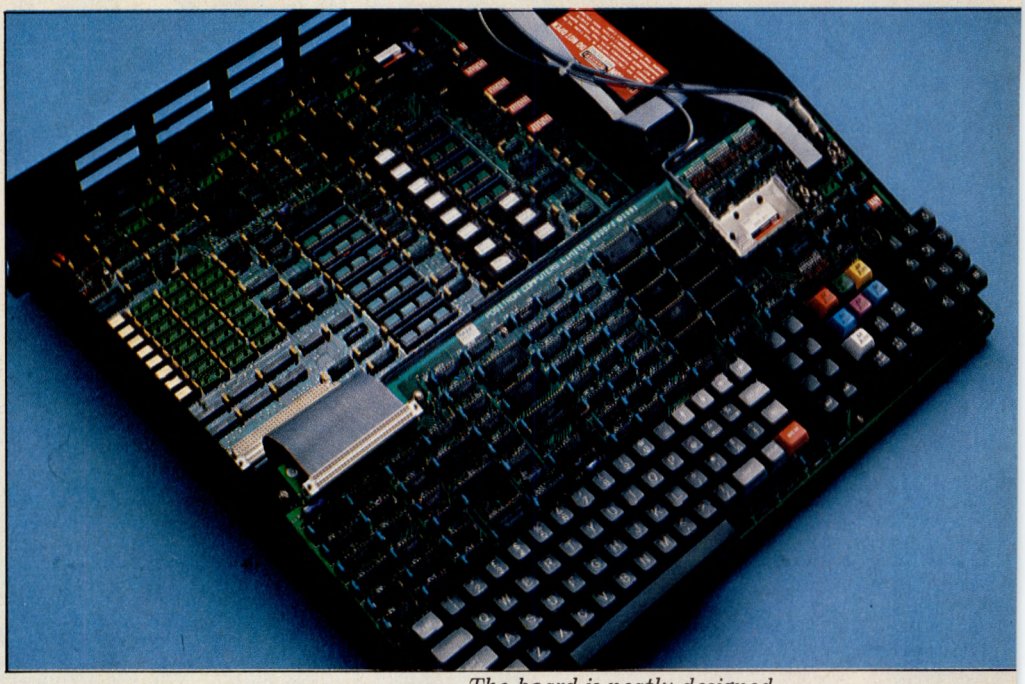
At the back of the box there are sockets for a cassette (1200 and 300 baud — remember Kansas City?), four RS232 devices (drivers exist for terminals and printers), an IEEE-488 port, and RGB, composite video and UHF output for the display. The review machine was equipped with a Decca colour monitor providing the more-or-less familiar 40 character by 24 line display. The top of the casing is retained by three screws on either side and, once removed, reveals the keyboard circuitry (supported at an ergonomic angle to the horizontal) beyond which lies the main board and a power supply. The logic supporting the Viewdata functions and 240x 240 pixel 'high resolution' graphics is on the keyboard board. Positron is apparently going to produce a 25x80 screen (and presumable an ASCII board) instead of the Prestel format, although it is also possible to buy the 9000 packaged without keyboard and monitor at all (the case, of course, is differently shaped). A wide ribbon cable connects the keyboard to the processor board.

The main board gives the appearance of a clean design with well-labelled areas, and is well made, with all the pricier chips socketed. The standard configuration provides 64k RAM and 36k ROM, although the review system seemed to have 44k's worth including software (8k). These were all in 4k ROMs but the sockets can optionally take 8k ROMs, and with all the sockets filled there is a potential 128k of ROM. The RAM is expandable (on board) up to 256k. The 6809 (Positron provides a 1 MHz version but will supply a 2 MHz chip with the faster memory required) will address only 64k, but this can be overcome by means of a bank of Motorola memory management units. The review machine was fitted with one of these and there were sockets for another seven. Each can cope with up to four concurrent processes, so it's not difficult to work out what the system is theoretically capable of. An extension board (which stacks above the main board, plugging into a socket similar to that used to connect the keyboard) allows both RAM and ROM to be doubled in size and provides another four RS232 sockets. However, OS-9 level 1 can only address 64k so any extension requires a software upgrade as well.

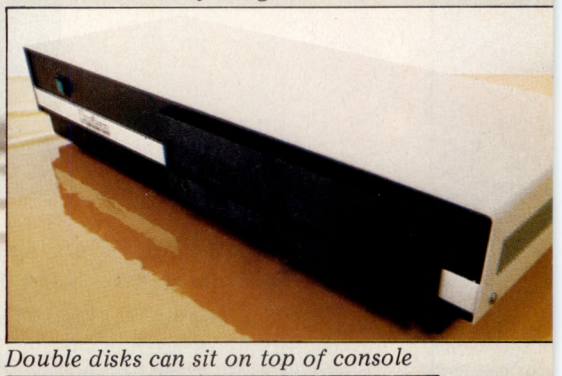
The four RS232 ports can be configured in two ways. Firstly, by repositioning a pair of chips mounted close to each port, the port can be set up as DTE or DCE. Second, a bank of DIP switches allows each port to be configured for speed (75-4800 baud) and handshaking. On the review machine we had problems getting the ports to work outside the factory settings. DIP switches also exist for configuring the IEEE-488 port and (on the keyboard board) for selecting the video display mode.

The disk drives come in metal cabinets the same width as the main processor box so that they can be stacked on top of it with the monitor perched (actually quite stably) on top of the lot. The review machine had a 5 Mbyte winchester in one cabinet (the Positron 9250) and a pair of 5¼in 380 kbyte floppies in another (the 9151). Drives are daisy-chained together on the IEEE-488 bus, each cabinet containing a controller board with its own processor and PROM to manage the actual drives. A single system is set up to take up to two 9151s (D0-D3) and up to four 9250s (D4-D7) where D0-D7 are the device numbers used by OS-9. Positron is also developing the 9300, an adapted disk controller whose PROM performs bus arbitration (instead of disk control) among IEEE devices, enabling a network of up to seven Positrons to share the resources of up to seven other devices (disks and a printer, say).

A fully expanded 9000 then would consist of ½ Mbyte of RAM, 256k of ROM, 12 terminal ports, four floppies and 20 Mbyte of winchester disks. Nobody really expects a single 6809 to be able to cope adequately with all that, but the flexibility of a system should be measured in the extent and number of directions in which expansion is possible. The same remarks probably apply to the fully expanded network.



The board is neatly designed.



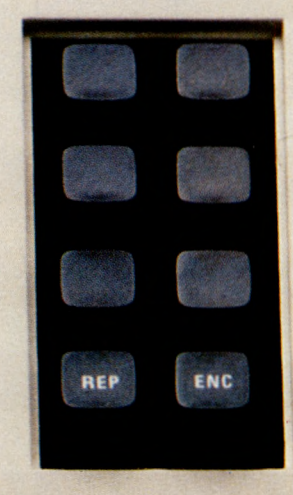
Double disks can sit on top of console

Software

OS9 is Unix-like. It is a multi-tasking/multi-user operating system based on a tree-like file structure. System utilities are invoked by issuing a command to the 'shell', a monitor program that, possibly, already has the capability to carry out the requested task, or which, more usually, calls a separate program to accomplish the task. OS9 deviates from the true Unix philosophy in that programs can be locked into memory so that retrieval of often-needed code from floppy disk drives does not degrade system performance.

OS9 fully supports the Unix concept of any process being able to spawn any number of 'daughter' processes (within the limits of availability of main memory); these are then processed concurrently with all the other processes in the system. New processes can be generated within a program, or by communication with the shell.

A NEW BRITISH MULTI-USER COMPUTER



Photography by Chris Stevens

INNOVATIVE

TRS 80-GENIE SOFTWARE

from the professionals

QUICKPROPLUS

Quickpro Plus is a Basic program generator. That is to say you tell it the type of program you want and it writes it for you. The most widely publicised of such program generators is The Last One and it is, therefore, inevitable that Quickpro Plus will be compared with it.

There are two approaches that one can take in writing software like this. Either one can set out with a very broad brush and try and make the generator capable of producing a wide variety of data handling software or one can restrict it to some extent, to simply producing file handling programs. The Last One seeks to go the first route, Quickpro Plus goes the second. There is a great paradox in this software if one thinks about it. Obviously, if a person is at least a semi-skilled programmer then he does not need a program generator. They are really for people who are not skilled in programming and want that chore taken off their hands. The paradox is that programs like The Last One, by being all things to all men are also complex in use and one therefore gets the position of a program aimed at a beginner, but actually requiring some skill to use it.

It was because of this apparent paradox that Quickpro Plus came into being. It is written for somebody with little or no knowledge. You will find no mention of flow-charts and little mention of fields, records and other technicalities. It was written so that a person could sit down in front of his computer, answer a few questions and have a program produced for him, and this is exactly what Quickpro Plus does. The other side of the coin is that it concentrates entirely on producing file handling programs. Within that context the program which you have generated will run on the computer like any other Basic program. You will be able to add file records, in other words items of information in your file. You will be able to search for and locate records, and retrieve these records, as and when you wish; you will be able to up-date and change the records, indeed you can delete them altogether. In the program generation process you will be able to design your own screen layout. Co-ordinates appear on the screen and you simply say where you want questions and statements to be inserted. You will, of course, be able to define whatever part of the record you will wish to use as a search key. These fields may be restricted if you wish to just numeric data and, of course, you may name the data file and indeed the program as you desire.

An added feature is that you may carry out various calculations on any of the numeric fields and if you want to you can change this numeric data. Up to fifty separate computations can be carried out on these fields. The program will report the calculations to you in various arrangements using any of the normal mathematical functions.

Quickpro Plus supports a full print report facility. Indeed within minutes you can design a new report with any column names that you choose, with any calculations that you might want and for many selections of records in your total file. A report will be produced within seconds. This can have been built into the program or you can re-arrange matters so that you get a one time reporting. The same file is thereby manipulated in many different ways. Computations are done and results printed all from the same file which your program has produced.

Quickpro Plus is available for the Model I, Model II and Model III Tandy machines, together with the original Video Genie, the Genie I and Genie II. A version for the Genie III will be available towards the end of 1982. Quickpro Plus is, of course, disk orientated and has no application for cassette users. It is supplied on a protected disk, but Molimerx have masters from which they can repair any damaged disks and hence retain their reputation for support.

The Last One is a Registered Trademark of D.J. A1 SYSTEM LTD.

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Tandy Model II **£108**

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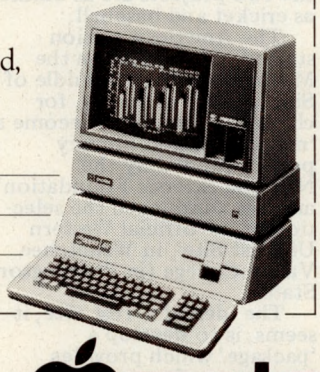

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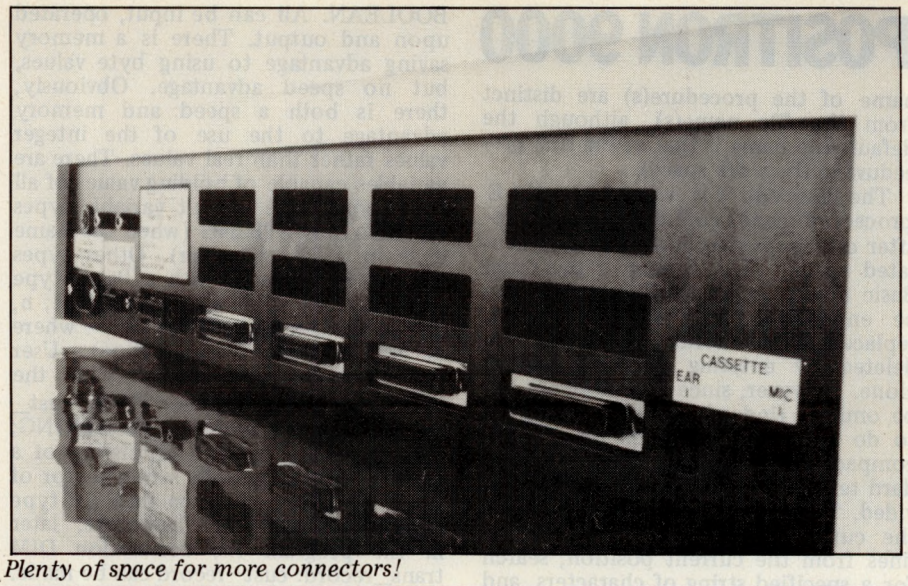

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OS9 supports re-entrant code. When the same program is called by more than one user, only one copy of the code is kept in main memory, and separate data areas are maintained for each use of the program. Each module (program) in main memory has a user count; when it is called the user count is incremented by one, and when the program is no longer required, the user count is decremented by one. When the user count reaches zero, the module is discarded.

In tree-structured file systems it is always necessary to specify the complete route through the tree structure to the individual files; this may be done implicitly or explicitly. If many of the files referenced are from a particular directory file, then it is usual to set that directory as the current directory; thereafter only the file name need be supplied, the rest of the path having been supplied implicitly. OS9 is rather unusual (and un-Unixlike) in that the user is regarded as being 'in' two directories simultaneously; a directory for data files and a directory for programs. These are called the data directory and the execution directory respectively. The supposed advantages of this are not very clear. The picture becomes even more complex when you realise that Basic program files that have been SAVEd are regarded as being data files, whereas Basic programs that have been compiled are stored in the execution directory.

Here's a quick rundown of OS9 commands: ATTR operates on the attributes of files; these are directory file/data-program file, file shareable between processes or unshareable (see below), owner readable, owner writeable, owner executable, public readable, public writeable, and public executeable. An owner is one with the same user number as the originator of the file.

DCHECK checks the integrity of the file structure on the specified disk. Sectors on the disk that are allocated to a user but recorded as free in the disk allocation bit-map are detected, and vice versa. Also, the pointers linking the various directories and files are checked.

The EX command allows a utility to be called without creating an additional version of the shell; this conserves memory space.

LOGIN together with TSMON is used to implement a multi-user System. For example, the command TSMON/T1 sets up a version of the time-sharing system to monitor terminal 1 for activity. Subsequently, any user of terminal 1 has to interact with the LOGIN program before being admitted to the system. The LOGIN command asks the user for his user name and password and the supplied values are compared with the contents of the password file which details all the permitted users of the system; access is granted only when acceptable values are supplied for user name and password. The password file also specifies a user number (0 to 65535, with user 0 as superuser, with special privileges), the CPU time priority, and the paths for the initial data and execution directories and the initial program for execution (usually the shell)'

PROCS displays a list of all the processes running on the system. The data given on the processes includes the user number, the process number, the priority level, the state (active, waiting for another process to terminate, or sleeping, suspended by self-request for a specified period or until receipt of a signal from another process). OS9 has a unified input/output system in which data transfers to all I/O devices are performed in almost exactly the same manner, regardless of the specific hardware devices involved. Thus, 'DIR > filedata' lists the contents of the data directory to the file filedata, rather than to the screen. Similarly, the command 'DIR >/P' would direct the output to the printer (parallel interface).

OS9 supports batch or background working. A command file containing the commands that make up the background job can be created with the BUILD command. If that file name is then issued to the shell then the commands will be executed. Background working can be ensured by setting the job priority to be low, with the SETPR command.

Multi-user access to individual files can be controlled with the shareable bit, set with the ATTR command (see above). When this bit is unset, simultaneous access by several processes is allowed. Unpredictable results caused by simultaneous access with WRITE rights is prevented with 'lock-out' of other users from the sector last read by a process; setting the shareable bit enables 'lock-out'.

Unfortunately, the BACKUP facility only works between disks of the same format; therefore, it cannot be used to backup the winchester onto floppies. There was supposed to be a DSAVE command, which scans the 'A' disk and generates a command file to copy all the files of the disk; we could not find DSAVE to test it. Since backup is important, and is done so frequently (isn't it?), and is so tedious and time-consuming, and is done when you are tired at the end of a hard session, then it should be easy to do. What is needed is a facility to scan the complete disk file structure, copy across files until the floppy is full, demand attention when this happens and pause for a response when a new floppy has been loaded, etc, until the backup has been done. There should also be a log of where each file has been stored, for later recovery purposes. Alternatively, a tree copy command would have helped; this would copy all the files and sub-directories that came below a specified directory. This would work okay if you could be sure that the selected sub-tree would fit onto a single floppy; otherwise you would have the problem of breaking up the tree structure.

As a multi-user operating system, OS9 has certain defects. For example, the activities of different users are not isolated from each other; it is possible for a process to access memory outside its legitimate address space (using POKE in Basic, for example). Thus, a program with bugs in it (and what program of any size is bug free?), can corrupt another's process. Also, it is possible to redirect input/output between user terminals without the other user's permission; this causes some very interesting effects. More seriously, files on disk backing store cannot be considered to be secure. When the '@' character is appended to the reference to a disk drive, then the whole disk is regarded as being a single file. It is possible to completely circumvent the file security system. A malicious individual could overwrite the complete contents of the disk. We should perhaps also mention, that if you set up the password file as suggested in the manual, it has public reading rights!

Basic 09

A language that can be compiled, has optional line numbers, needs a line editor to change the program, has Pascal-like control structures (plus some more) and variable typing and declarations (in addition to the usual Basic ones) and has Fortran type integer, real and character descriptors in the PRINT USING statements cannot sensibly be called Basic.

Basic09 is strongly orientated towards the use of procedures. When one invokes Basic09 one needs to supply the name of a procedure (by means of the LOAD command — load a procedure file, or the E command — edit a procedure), or the system chooses the exciting name PROGRAM. Editing takes place within one procedure, until you exit from that procedure. One can load more than one procedure into the Basic workspace, and can save one or all the procedures into a named file (the

name of the procedure(s) are distinct from the file name(s), although the default file name is that of the first procedure in the work space).

The Basic editor is entered with the E (procedure name) command, and thereafter can be used for line or string orientated editing. The former is the usual Basic mode, where numbered lines can be entered in any order, a line is replaced by re-entering it, and lines are deleted by entering the line number alone. However, since line numbers can be omitted (indeed you are encouraged to do so, to make the program more compact and faster in execution), standard text editor commands are also provided. These include, insert lines above the current line, delete one or more lines from the current position, search for a specified string of characters, and replace the specified string by another string (either for the first occurence, or globally throughout the procedure). Lines are parsed, and converted to an internal format immediately on entering, rather than at run-time as is more usual with microcomputer implementations of Basic. An additional benefit of this approach is that reserved words (eg, FOR, NEXT, etc) are printed in upper case, regardless of the case in which they are entered. This aids clarity; unfortunately, it also means that when you use the string search or string change commands, you may have to remember to SHIFT to upper case (very annoying). What is less nice about the editor is that one backtracks a line with the '—' symbol and moves to the top of the procedure with the '—*' combination; these characters required a SHIFT on the keyboard, and are therefore two-handed operations. One exits from the editor with the Q command; subsequently the interpreter carries out further syntactic checks that could not have been done on a line by line basis (eg, for undeclared arrays).

Once back in SYSTEM mode (as opposed to EDIT mode above), one can issue many of the usual Basic commands: LOAD, SAVE, LIST, RUN, etc. There is room for criticism of the ease of use of some of these commands; For example, in the editor one enters 'l*' to list the procedure, but LIST is required in SYSTEM mode to list the last used procedure in the Basic workspace. LIST*, however, causes all the procedures in the workspace to be listed. Where this really matters is with the SAVE command, which saves the last used procedure, and SAVE*, which saves all the procedures in the workspace; in both cases the default file name is that of the first procedure in the workspace. Thus, if you enter SAVE (or, even, SAVE *) instead of SAVE* onto an existing SAVEd file, then you lose all the procedures except for the first.

One unusual command is PACK, which compiles the procedure(s) and stores the result in the execution directory (which you may be sharing with many other users, of course!). Also, commands can be issued to the SHELL from SYSTEM mode, by inserting a '$' character in front of the command.

The atomic data types of Basic09 are BYTE, INTEGER, REAL, STRING and BOOLEAN. All can be input, operated upon and output. There is a memory saving advantage to using byte values, but no speed advantage. Obviously, there is both a speed and memory advantage to the use of the integer values rather than real values. There are variables capable of holding values of all these types. The default variable types are REAL or STRING (when the name ends in a '$' character). Other types have to be declared with a Pascal-type construct (eg, DIM a,b,c:INTEGER; n, m: decimal; x,y,z:BOOLEAN — where decimal is a user defined type). User defined types are created with the TYPE statement. Thus, TYPE cust_ record = name, address (3): STRING; balance creates a type consisting of a name string, an address string vector of three elements, and a balance (of type REAL, by default). Therefore, later in the program the declaration DIM trans_record: cust—record can be made.

Both sequential and random access files can be accessed from Basic09. There are statements to CREATE, OPEN, CLOSE and DELETE files; one can specify READ, WRITE, UPDATE (both READ and WRITE access), EXEC (open in the execution directory, rather than the data directory) or DIR (open a directory file — can only be used for READ access). Sequential files contain only ASCII data and are accessed with the usual Basic commands of READ <channel> and write <channel>; these carry out any necessary conversions to ASCII format (eg, of numeric values). Random access files contain identical representations to those used in main memory. Thus, the conversion overhead is avoided (although the files are no longer human-readable with the LIST command). One can move to any byte position in the file with the SEEK command. Transfer to and from the file is accomplished with the PUT and GET Statements. These can operate on simple variables, arrays, strings, or complex user-defined structures. The last is very useful, and can be contrasted with the input/output of structures to the standard I/O paths, where each item of the structure has to be handled individually.

Basic09 is very well served for control statements. These are IF <condition> THEN <linenumber>, IF <condition> THEN <blockofstatements> ENDIF, IF <condition> THEN <blockofstatements> ELSE <blockofstatements> ENDIF, two FOR/NEXT (selected by the interpreter/compiler on the basis of the loop variable type — REAL or INTEGER, the latter is faster), WHILE <condition> DO <blockofstatements> ENDWHILE, and a REPEAT <blockof statements> UNTIL <condition>. Unlike Microsoft-type Basics, <blockofstatements> can be of any length, and the statements are not confined to one line. If that were not enough, there is a LOOP <blockofstatements> ENDLOOP construct which sets up an 'indefinite' loop. Exiting from this loop is accomplished with an EXITIF <condition> THEN <blockofstatements> ENDEXIT construct. When the condition is satisfied, then the block of statements is executed, before control is transfered to the statement below the ENDLOOP statement. Several of these constructs can be included within one loop. This provides a very nice answer to the situation when one wishes to exit from a loop for one of a variety of reasons and to carry out various tasks depending on the particular condition. Basic09 also provides the more usual GOTO, GOSUB/RETURN, ON... GOTO, ON... GOSUB and ON ERROR GOTO constructs.

Basic09 procedures are completely self-contained as regards variables and line numbers. Values may be passed by reference (by default) or by value. The former is the more common, and means that the address of the memory location is passed to the called procedure; this allows the location to be modified before returning to the calling procedure. In call-by-value, only the value is passed to the called procedure, and hence the value is protected against modification. The method by which call-by-value is selected is rather clumsy; an expression is supplied to provide the required value. If the value is to be extracted from a single variable then an expression must be forced, by adding 0 to the variable, for example. Unusually, if a procedure is to accept values from a calling procedure then the variables in the called procedure are not declared with a DIM statement, but with the PARAM statement; the syntax is identical to the DIM statement. Whereas the DIM statement causes memory space to be set aside. PARAM does not.

Other minor details of Basic09 are: PEEK and POKE are allowed; commands to the shell can be issued with the SHELL command, followed by the actual command in string quotes (eg, SHELL 'copy file1 file2'); TRON and TROFF set the trace flag; one can set whether the storage locations specified in the DIM Statements run from 0 to N—1 or 1 to N with the BASE0 and BASE1 statements respectively (the latter is the default); the usual READ/DATA internal data system is supported.

PRINT USING is very unusual, being based on Fortan-type descriptors. Thus I4 specifies that the integer should be presented to four digits, R8.2 specifies that the real number must be presented with a field width of eight (including provision for the sign and for the decimal point) and with two decimal places; E10.2 specifies that a number should be presented in standard form, with a total width of 10 places (including the six positions for sign, decimal point and exponent), and two decimal places. Descriptors also exist for outputting numbers in hexadecimal form, for strings and for boolean values.

If during program execution any of the following conditions arise then Basic09 enters DEBUG mode:

i. an error occurs that is not intercepted by an ON ERROR GOTO statement;
ii. a PAUSE statement is executed; or
iii a keyboard interrupt (CONTRL/C) occurs.

In DEBUG mode you can:

i send commands to the shell;
ii set up break-points;
iii CONTinue program execution;
iv list a DIRectory;
v Quit DEBUG mode;
vi assign values to program variables;
vii LIST the suspended procedure;
viii PRINT values of procedure variables;
ix set the trig function mode to RADian or DEGree; and

x call the 'nesting' order of all active procedures.

Access to the 'high resolution' graphics (240x240) of the system is via a procedure LINE. Little documentation was available on how one could exploit the graphics system, although no doubt something could be worked out using LINE and POKE statements. Nevertheless, in comparison with the very much cheaper BBC and Sinclair Spectrum systems, the graphics facilities can only be described as thin. Access to the 'system console', ie, the main keyboard as opposed to additional user VDUs, would be necessary to display graphics: this could pose security problems when used by school pupils, students, etc, in an educational establishment.

One could take one of two opposing views to Basic09. One could say it's a dog's breakfast of features from Basic, Pascal and Fortran; or one could say that it is a sensible attempt to combine the best of the other three languages, although, inevitably, some will dispute whether it does achieve that. A possible criticism of Basic09 is that it is peculiar (ie, unusual), which nullifies one of the supposed advantages of high level languages — their consistency across many computer systems (hollow laugh in the case of Basic). If one regards Basic as what it was originally intended to be, ie, a beginner's language, then Basic09 is easily defended. It introduces programming constructs such as sophisticated control loops, user-defined structures (cf Pascal and Algol 68), procedures (and pass by reference and value), and so on, in a much easier format than, say, Pascal or Algol 68. If Basic is to be regarded as a standard programming language, with some degree of standardisation, then Basic09 offends more against the minimal Basic standards than do most implementations. Nevertheless, in its own right it is a powerful and easy to use language.

OS-9 Pascal

Microware Systems' Pascal compiler generates p-code objects which can be interpreted by a 'normal' interpreter (PascalN) or a 'swapping' interpreter (PascalS) for large programs. Alternatively, PascalT is a native-code translator which accepts p-code files as input and produces 6809 assembly language source code. The compiler is invoked by means of a fairly complex command line:

Pascal (source p/n)list p/n)) stats p/n exec. options: parameters

(where p/n stands for 'pathname'). Of these, only the source pathname is mandatory (unless you want to type the code straight off the keyboard directly into the compiler). Two standard output files are produced by the compiler, PCODEF (the actual codefile) and PROCTAB, the compiler's workfile which is left in the data directory after the compiler exits (rather untidy). The 'parameters' field in the command-line can be used to redirect these files to other pathnames — essential if two or more users are to share the same data directory. In addition there are parameters to specify the format and extent of source and symbol-table listings, inhibit run-time range-checking and suppress the insertion of (diagnostic) source line-numbers into the p-code.

Optional range-checking covers array-bounds, memory references via pointers, and boolean and subrange type assignments. Exec-options define stack, heap and swapping buffer sizes together with string justification (leading or trailing blanks), MOD function algorithm, run-time error response and heap control options. Pseudo-comments covering most of the parameter and exec options may alternatively be embedded in the Pascal source. The list and stats pathnames default to the terminal-convenient for the most interactive program development.

The compiler allocates one byte of storage for each character and boolean, two bytes for each integer and five bytes for reals (ie, about nine significant (decimal) digits * E±38). String constants may extend to 100 bytes and procedures may contain a maximum of 32 kbytes of p-code each while a program may have up to 254 procedures declared within it. The compiler will accept hexadecimal constants, prefixed with a '$' sign. The keyword OTHERWISE has been added to the CASE construct as a catch-all clause. The compiler accepts subrange specifiers (eg, 'a'. .'z') both within CASE definitions and SET membership assignments.

Both p-code interpreters are invoked by a command line of the following form:

PASCALx <input p/n >output p/n >>
syserr pcodename exec.options:params

'x' is either 'N' or 'S' depending on interpreter. Input and Output are the standard Pascal I/O files while Syserr is a standard OS-9 device which has been added to the Pascal standard devices. The pathname 'pcodename' is the only mandatory entry, being the actual codefile. Considering its position in the command line, in relation to the source-file in a compiler's command line, one can see that the Pascal environment is not especially 'orthogonal'. Params. is a user-defined string which is passed directly to the program once execution begins (so that a user-written program can behave similarly to an OS-9 utility, accepting a 'command line'). This is a nice feature but not as powerful as it might be under version 1 of OS-9 since the command line operators ('<', '>', '&', etc) are not allowed.

The swapping interpreter implements a full fixed-page virtual code swapping algorithm whereby a minimum of eight 256-byte pages are maintained in memory and only the code for locked or active procedures need exist in memory at any time. Strings are stored in separate pages so that additional pages (over the eight) need to be allocated for procedures which reference strings and remain active. Obviously, the more pages allocated the more efficiently the program will run, and the manual emphasises that an experimental approach must be adopted in optimising performance.

PascalT is a Pascal program which translates p-code into 6809 assembler language. Up to 36 reduction rules are employed to optimise for speed and space, although, on average, each byte of p-code generates just under two-and-a-half bytes of native code, so care needs to be exercised when translating large programs, especially on a floppy-based system. PascalT runs under the PascalS interpreter and prompts for input and output filenames. Not all procedures in a program need to be translated into a single output module with a separate file of (external definition) references for subsequent use by the link/load utility PascalE. It is possible to embed the original source line-numbers in the assembly file. If the partial translation is done, the relevant procedures must be removed from the Pascal source-file and replaced with external references. The modified Pascal source-file is then re-compiled before being linked with the assembled native-code module. Native-code modules may not be swapped (which probably explains why PascalT must run under PascalS).

If an entire program is translated it can be invoked by:

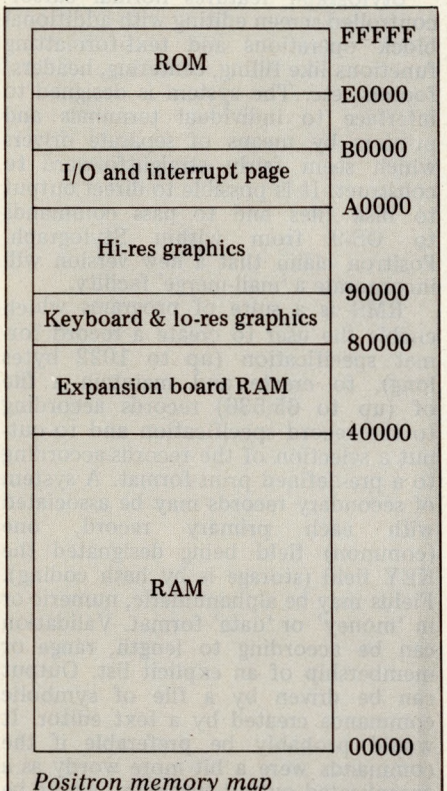
program <input >output >>
syserr exec.options :parameters

where all terms are as previously described for the interpreters including the parameter string 'parameters'. For true optimisation it is necessary for the user to provide PascalT with information about local and extended stack and heap space — this is prompted for during execution.

Apart from the CASE statement extensions mentioned earlier, OS-9 Pascal differs from standard Pascal in that the underscore character is recognised in identifiers; strings are implemented; procedures and functions may not be passed by name; files may not be passed by value (and may be omitted in the PROGRAM statement); DISPOSE, PACK and UNPACK are not implemented and PACKED is ignored (although variable space is allocated on byte boundaries). Character arrays can be indexed (in their right-most dimension) by the form 'p FOR q' where p and q are integers such that p is the index of the first element to be referenced and p+q is the element of the last element referenced. Thus:

String [1 FOR 5] ;= 'ERROR'.

OS-9 distinguishes between 'terminal-like' (SCF) and 'disk-like' (RBF) devices



Positron memory map

and this distinction is carried over into the OS-9 Pascal I/O. RBF files follow the proper language specification while SCF files get around the usual Pascal 'interactive' problem by only loading the buffers when they are needed (lazy I/O). This means the EOLN and EOF functions behave slightly differently for the two types of file. The boolean function INTERACTIVE(filename), which returns a value of TRUE whenever 'filename' refers to an SCF-type file, must be employed to provide the customary interactive I/O. A number of 'standard' procedures and functions are provided for file-handling and interacting with OS-9. These include the ability to access the file of error-messages and to suppress non-fatal OS-9 I/O errors. Other procedures and functions allow, among other things, for the trapping of certain arithmetic errors (overflow, range, divide by zero); bit manipulation within integers and forking to the SHELL. There are three run-time support packages, SUPPORT (9k), which contains all routines, SUPPORT1 (7k), which lacks the transcendental functions and SUPPORT2 (5k) which lacks support for any reals and some of the file-handling procedures.

Other software

Several other software items which, for one reason or another, we were not able to review in much detail include a full implementation of CIS Cobol; a C compiler; an interactive assembler and debugger; a word-processing package, Stylograph; and RMS, a record management system. According to Positron, negotiations are underway to obtain a rather fruity suite of commercial packages which will run on the system via the CIS Cobol implementation.

Stylograph features normal cursor-controlled screen editing with additional block operations and text-formatting functions like filling, centering, headers/footers, etc. The system is designed to interface to individual terminals and printers by means of separate drivers which seem fairly straightforward to construct. It is possible to direct output to disk files and to pass commands to OS-9 from within Stylograph. Positron claim that a new version will incorporate a 'mail-merge' facility.

RMS is a suite of programs which enable the user to create a record format specification (up to 1022 bytes long), to create and maintain a file of (up to 65,536) records according to the record specification and to output a selection of the records according to a pre-defined print-format. A system of secondary records may be associated with each primary record, one (common) field being designated the KEY field (storage is by hash coding). Fields may be alphanumeric, numeric or in 'money' or 'data' format. Validation can be according to length, range or membership of an explicit list. Output can be driven by a file of symbolic commands created by a text editor. It would probably be preferable if the commands were a bit more wordy as a complicated output 'program' would be quite difficult to debug. Index files (which merely contain a list of KEY values in some significant order) can be used to access the file selectively — but these must be assembled 'by hand' with a text editor and ordered with a SORT/MERGE package (not supplied). Overall, it seems convenient and flexible to use although not particularly powerful or comprehensive.

Potential

The Positron 9000 is a difficult system to place in the marketplace. It's too different (and a bit too expensive) to compete with any of the standard, single-user CP/M systems with their huge repertoire of software; it certainly isn't a hobbyist machine; yet it offers a multi-tasking operating system (not necessarily even with disks!), a substantial expansion pathway and the potential for multiple users. At the same time there is the Viewdata terminal capability which doesn't really seem to fit in with the rest of the system.

In fact, the machine has been offered for some time to schools but while Basic09 is a very reasonable language with which to learn programming (as is Pascal), we felt that the multi-user aspects of OS-9 (level 1) were not sufficiently robust to provide a stable programming environment for a number of (beginning) users. Keyboard operations are noticably affected when more than one user is active (hard to expect beginners to take this into account); and we found that the system rejected processes when memory filled up (instead of, perhaps, queuing them), requiring human intervention (hence a supervisor). Perhaps level 2 of the operating system copes better with these problems.

On the other hand, the 6809 is a processor well-known to and much admired by a number of digital designers and any professional who takes the trouble to learn the intricacies of OS-9 (and that includes Unix programmers) should be able to construct themselves a fairly comfortable development environment. The system has a vast capacity for ROM and provides a cheap route to multi-tasking which should mean that, with careful programming, a fairly robust, turnkey delivery system could be built. We would guess that such a system, with its well-designed boards and expansion capabilities, should appeal to industrial OEMs, especially those expecting to exploit GPIB devices, provided they don't need to push that single little processor too hard. Additionally, a nationwide maintenance service is provided for Positron by Fisons Scientific.

Documentation

The documentation was of a quality which computer professionals have grown to expect — that is, most of the information was there if one was prepared to persevere. We estimated that about five passes through the manuals would be necessary to resolve all unknown references! They were

Basic Benchmarks

BM1	1.1
BM2	2.1
BM3	5.4
BM4	6.8
BM5	7.2
BM6	14.9
BM7	20.2
BM8	12.0

All timings in seconds. For an explanation and listing of the Benchmark programs, see PCW *Vol 4 no 11.*

Pascal Benchmarks

magnifier	5.2
forloop	59.3
whileloop	73.3
repeatloop	67.0
literalassign	72.5
memoryaccess	73.4
realarithmetic	61.8
realalgebra	48.1
vector	172.9
equalif	115.1
unequalif	110.4
noparameters	38.6
value	41.2
reference	41.9
maths	32.9

These figures were obtained with the interpreter PascalN. We would have liked to have obtained figures for the native-code (PascalT) version but ran out of time.

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9000/40	the review system with Viewdata keyboard	£1536
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Technical data

CPU:	MC6809 (1 MHz)
Video:	24x24 Viewdata colour, 240x240 pixels
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ROM:	36k — 256k
Comms:	Cassette (300, 1200 baud), IEEE-488, 4—12 RS232
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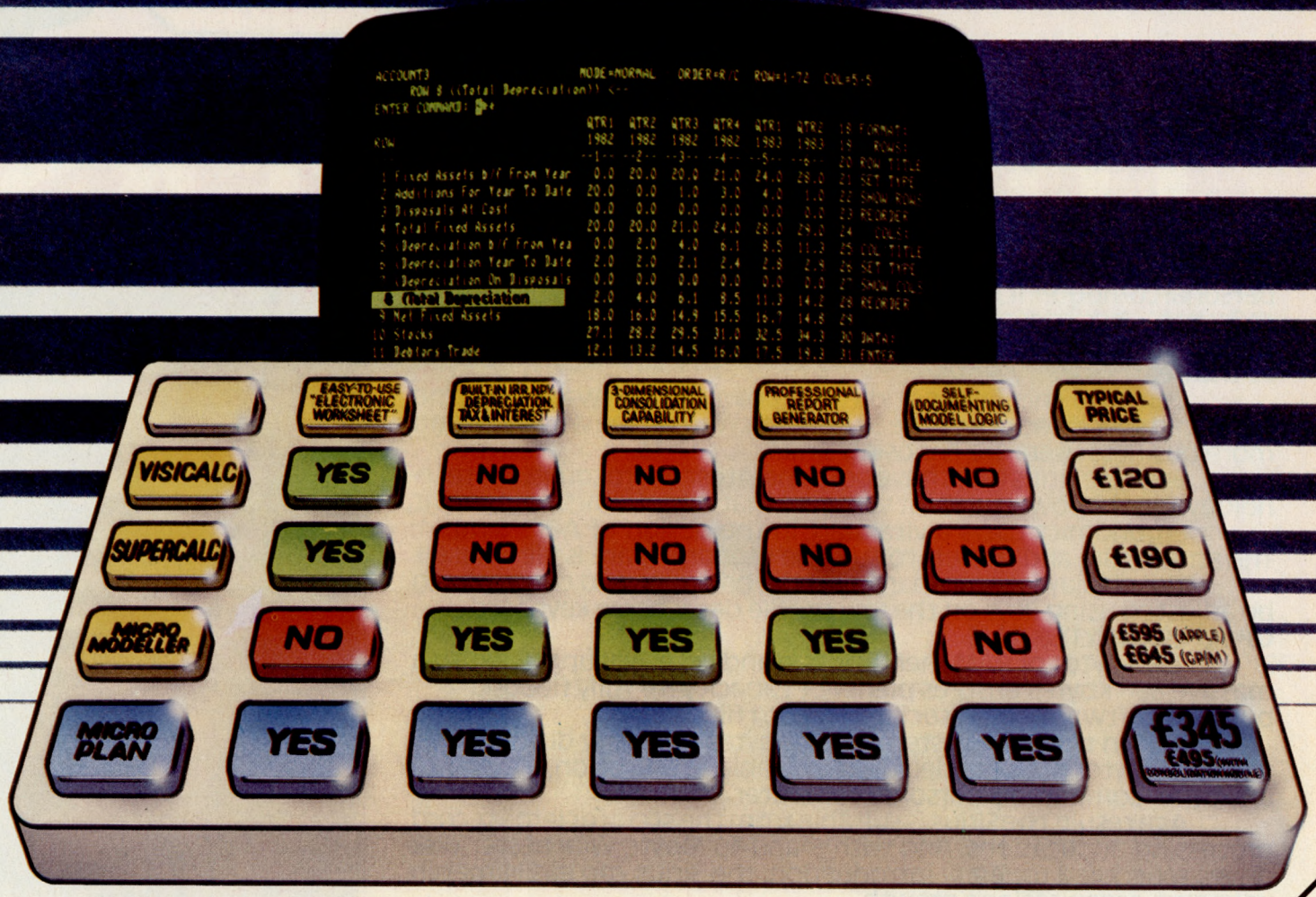

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THE ULTIMATE TEST?

by Chris Sadler and Sue Eisenbach

In the September issue of *Byte* magazine, Jim Gilbreath, head of the Computer Sciences and Simulations Department of the Naval Ocean Systems Centre in San Diego, published a benchmark program which he had translated into 10 different languages and run on dozens of different machines and compilers.

While preparing last month's article on the different language translators available under SofTech's UCSD (version IV) p-System, we decided to use his program to compare the efficiency of the p-code produced by the p-System's Pascal, Fortran 77 and Basic compilers. Frankly, since the p-System is so well-known for its Pascal, we had expected that only lip-service would have been paid to the problem of optimising the p-code statements generated by the other two compilers. The benchmark uses an algorithm based on the Sieve of Eratosthenes to compute the 1899 prime numbers between 3 and 16384.

Once a prime is found, all multiples within range are eliminated, and this information has to be remembered for subsequent processing, so quite a lot of storage is necessary. Unfortunately, SofTech's Basic did not have room in RAM for the 8k in reals (we decided not to use virtual arrays as we didn't want to compare disk and RAM accessing) required by the *Byte* program and in the end we had to reduce the array to 4k of integers before it would fit in — ie, all primes from 3 to 8181. The programs in Pascal and Fortran are set up to do 10 iterations of the algorithm (as in the original article), although the figures presented below are for a single pass in order to be comparable with the Basic program. The reason Jim Gilbreath built in the different iteration count was to get similar figures for compiled and interpreted code — but since, on the p-System, all the programs are compiled into p-code which is subsequently interpreted, the need for this distinction disappears.

GOTO page 207

```
10 REM ERATOSTHENES SIEVE PRIME
   NUMBER PROGRAM IN BASIC
20 INTEGER ALL
30 SYZE = 4094
40 DIM FLAG(4095)
50 DISPLAY "ONLY 1 ITERATION"
60 COUNT = 0
70     FOR I = 0 TO SYZE
80       FLAG(I) =1
90     NEXT I
100    FOR I = 0 TO SYZE
110       IF FLAG(I) =0 THEN 180
120       PRIME = I+I+3
130       K = I + PRIME
140       IF K>SYZE THEN 170
150       FLAG(K) = 0
160       K = K + PRIME
170       GOTO 130
180       COUNT = COUNT + 1
185       REM DISPLAY PRIME
190    NEXT I
200 DISPLAY COUNT," PRIMES"
210 END
```

Language	Compile time	8k primes	16k primes
Basic	33.6 secs	15.7 secs	—
Fortran	27.7 secs	14.1 secs	28.6 secs
Pascal	28.1 secs	13.0 secs	26.6 secs
UCSD Pascal	30.6 secs	11.0 secs	20.4 secs

Table 1

```
      Program Primer;
      { Eratosthenes Sieve Prime Number Program
      using UCSD Pascal features }

  Const size = 4094;

  Var flags : Array [0..size] of Boolean ;
      i, prime, k, count, iter : Integer ; .

  Begin
      Writeln ('10 iterations') ;
      For iter := 1 to 10 Do
      Begin
          count := 0 ;
          fillchar(flags, sizeof(flags), true) ;
          For i := 0 to size Do
              If flags[i]
              Then
              Begin
                  prime := i+i+3 ;
                  k := i + prime ;
                  While k <= size Do
                  Begin
                      flags[k] := False ;
                      k := k + prime
                  End ;
                  count := count + 1
              End
      End ;
      Writeln (count, ' primes')
  End .
```

```
C       Eratosthenes Sieve Prime Number Program
        in FORTRAN

        LOGICAL FLAGS (8191)
        INTEGER I, PRIME, K, COUNT, ITER
        WRITE (1,50)
 50     FORMAT (' 10 Iterations')
        DO 92 ITER = 1, 10
          COUNT = 0
          DO 10 I = 0, 8190
 10       FLAGS(I) = .TRUE.
          DO 91 I = 0, 8190
            IF (FLAGS(I) .EQ. .FALSE.) GOTO 91
            PRIME = I + I + 3
            K = I + PRIME
   20       IF (K .GT. 8190) GOTO 90
            FLAGS(K) = .FALSE.
            K = K + PRIME
            GOTO 20
   90       COUNT = COUNT + 1
C           WRITE(1, 100) COUNT
   91     CONTINUE
   92   CONTINUE
        WRITE(1, 200) COUNT
        STOP
  100   FORMAT(1X, I6)
  200   FORMAT(1X,I6,' Primes')
        END
```

```
Program Primer;
{ Eratosthenes Sieve Prime Number
Program in Pascal }


 Const size = 8190;

 Var flags : Array [0..size] of Boolean ;
     i, prime, k, count, iter : Integer ;

 Begin
     Writeln ('10 iterations') ;
     For iter := 1 to 10 Do
     Begin
         count := 0 ;
         For i := 0 to size Do flags [i] := True ;
         For i := 0 to size Do
             If flags[i]
             Then
             Begin
                 prime := i+i+3 ;
                 k := i + prime ;
                 While k <= size Do
                 Begin
                     flags[k] := False ;
                     k := k + prime
                 End ;
                 count := count + 1
             End
     End ;
     Writeln (count, ' primes')
```

A high-level language benchmark

STEREO GRAPHICS!

Paul Stevenson outlines a neat and novel way to get 3-D on a micro

Now that high resolution colour graphics, in various forms, are becoming available in small computers the possibility exists of generating the traditional red/green image pairs necessary to produce a three-dimensional stereoscopic image when viewed through a pair of spectacles with a red filter over one eye and a green over the other.

The geometrical theory behind the positioning in the red and green parts of the image will be given and one example program for the BBC/Acorn computer is included. Finally, possible applications are considered.

Consider first the red and green images which would have to be produced on the page of a book to give the image of a pyramid standing vertically from the page when viewed from 45 degrees. (see Fig 1). This example is chosen because it works particularly well and because the programming is particularly simple when it is later transferred to a VDU screen.

Assume that eye L is to view through a green filter and that eye R looks through a red one. The desired final image is shown in black WXYZA. The eyes are taken as being 6 cm apart. Since a red line on a white ground should not be visible through a red filter and should appear black through a green one and a green line will similarly not be visible through a green filter but will appear black through a red filter, the images of the intended pyramid as seen by each eye separately can be extrapolated back to lines projected onto the horizontal surface as shown. In fact, for simplicity, the only point in the example which needs extrapolating is the apex of the pyramid A, if one assumes that the base of the pyramid lies in the plane of the page. This gives projected points GA and RA as seen by the right and left eyes respectively. Thus all that has to be done to define the green image on the page (screen) is to join GA to the points WXYZ. The red image can then be joined up in a similar manner. In the example the red and green images are symetrically placed with respect to the centre line but this need not be so for other objects.

Fig 2 shows the final appearance of the images on the screen or page. Note that around the base WXYZ, where both red and green images overlie each other, the line should be plotted in black since it has to be present at *both* eyes. The final image received by the brain is in monochrome. Both the BBC and RML 380Z machines make provision for making the logical AND function of the plotted red and green colours equate to black and this is a distinct advantage in the programming.

Fig 3 shows the viewing situation for the example program — it was arranged this way because the final pyramid was required 'correct way up'. (There are other ways of achieving this with the VDU arranged conventionally but the geometry is much harder to explain.) The effect is very powerful if the filters are closely matched to the colours on the screen (more on that later).

Having decided to replace the page with a VDU screen placed horizontally then essentially all that one has to do is to decide on:

a) the size (centimetres) of the pyramid base;
b) the height of the pyramid;
c) the viewing distance and angle (50 cms and 45 degrees in this example);
a) and b) are both variables presented to the program.

What remains in to calculate the screen coordinates of WXY and Z and of the points GA and RA. This involves only simple ratios in similar triangles. At a late stage in the program the position of points GA and RA will have to be converted from centimetres to plottable screen points. This conversion will depend on the resolution of the graphics employed but in the BBC/Acorn machine used this conveniently works out on both axes at about 55 points per centimetre.

The program is listed in Fig 4 and is written in BBC/Acorn Basic but as far as possible it has been kept to a common subset of Basic. For instance, no graphics offset origin or procedure calls been used, both of which would have simplified the code.

Extensions to the program

The following extensions to this simple program are possible if there is a drive to experiment.

First offset the apex of the pyramid relative to the base. Secondly raise the base itself itself off the actual screen. The latter task involves calculating the red and green image positions for all four corners of the base as they will not now overlie each other. The pyramid can now be made to appear suspended above the screen surface (yes it does work) but the height it appears above the screen surface is limited by the screen size you are using — the images start to plot off the top of the screen area if it is raised too high.

A third possibility is to experiment with the viewing angle, but this has not been tried yet. In relation to this, to avoid the silly situation of a VDU monitor lying on its back, a 45 degree viewing angle can be obtained with the VDU in its 'normal' position but with the view standing 45 degrees 'above' the screen. This is more convenient for viewing — the images are plotted 'down the screen' — GA and RA are near the bottom, but the pyramid 'sticks out' towards the keyboard (not so useful for teaching). Talking about teaching use — here is a snag! The effect can only be seen well by one or two people at a time. There appears to be considerable latitude in both viewing distance and angle of view before the effect disappears altogether but at non optimal positions the pyramid is 'distorted'.

Depth illusions

A program has been experimented with, whereby a framework cube is made to appear suspended in the space between the viewer and the screen (see Fig 5).

With appropriate image placing on the screen, the cube can be made to appear, say, halfway between the viewer and the screen. Using the same type of geometry as before the projections of the cube corners onto the screen from each eye can be calculated and then plotted. The effect works but it is (or appears) more difficult to 'conjure up' as it needs the eyes to be focused on empty space at the halfway point where there is nothing there to start with. The main source of light — the screen — acts as a distractor. If the image is on or near the screen everything appears to work much better.

This program has, as input variables,

Lines 40 and 50	fix the pyramid height and base in centimetres.
Line 60	sets a variable to half the base length. The 55 converts from centimetres to screen units.
Line 100	selects the appropriate graphics mode (four colours)
Lines 110 to 116	sets the colours to red and green, with a white background for the graphics.
Line 130	clears the graphics area to its white background.
Line 140	calculates the length of GA to 0 (Fig 1) in cms. The 40.11 is the length of OT (one could almost use 40 cms).
Line 150	calculates the displacement left of the centre line for the point GA in screen units this time.
Line 160	calculates a similar displacement up the screen.
Line 410	choses colour green.
Lines 420 to 510	draws the green image.
Line 655	since the green and red images are symmetrical this sets the displacement right of the centre line for RA. (DU is the same as before.)
Line 660	The clever one! This choses red to plot unless the colour already there is green in which case it draws black. This will make the red/green overlap areas the correct colour.
Lines 670 to 760	plots the red image.
Line 998	waits for any key before restarting.

Program explanation — see fig 4.

the distance of the desired cube from the eyes, its size, and its angle to the horizontal.

Images behind the screen

The principle here is the same as in a) but beware — the relative placings of the red and green images are reversed left for right.

Fig 6 should make this clear and illustrates how a frame cube could be made to appear *inside* the VDU tube. Beware of this red/green reversal effect if you have an object which you wish to intersect the screen. The same difficulties about distraction during focusing apply as in a) — the light from the screen has to be ignored as far as possible.

Selection and rotation of objects

For trial purposes select simple objects. Each corner on an object has to have a projection calculated onto the image plane, and the fewer there are the better. Leave a scale model of the Starship Enterprise till later!

Rotation has been tried with the cube revolving in space between viewer and screen but Basic is too slow to get a nice effect — machine code must be used here.

Practical points

The matching of the filter material bandpass to the intensity/depth of the colour red or green is important. Through even the best red filter some vestige of the red line will be visible on the screen. Reducing overall screen brightness seems to help here. The relative 'blackness' of each colour when viewed through its opposite colour filter should be the same. If one is black and

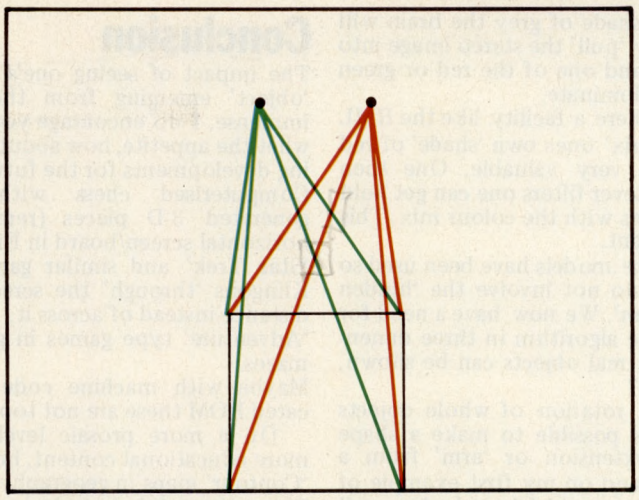


Fig 2. Final images as they appear on the screen or page.

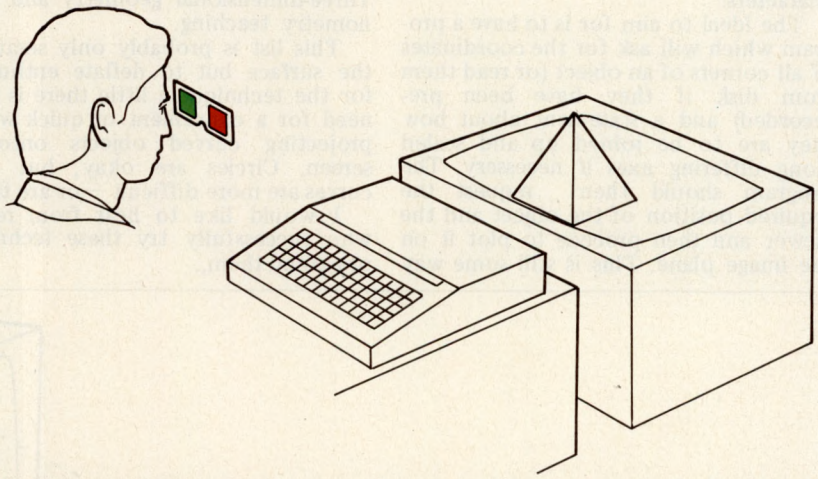


Fig 3. Viewing situation for the example program (put feet on the back of your VDU!!).

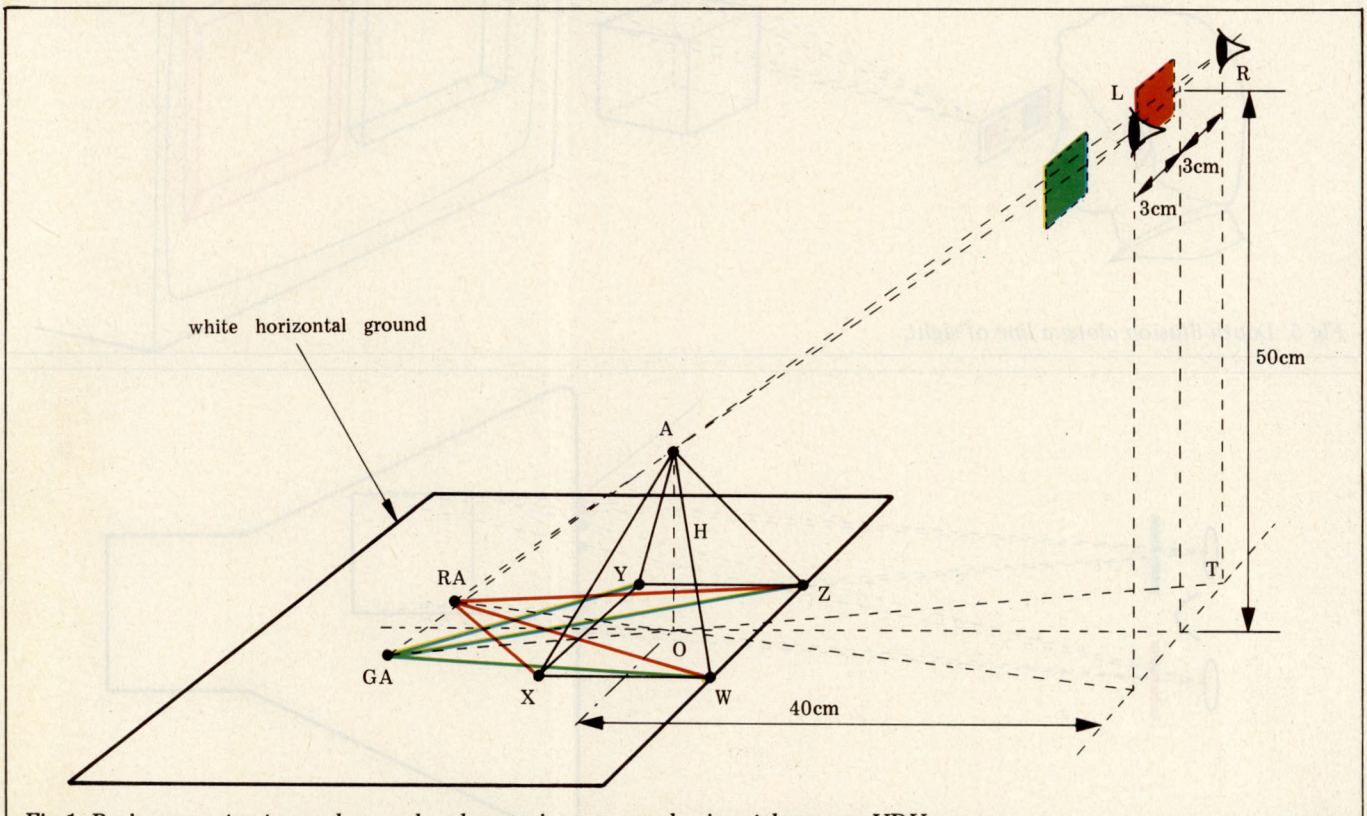


Fig 1. Basic geometry to produce red and green images on a horizontal page or VDU screen.

STEREO GRAPHICS!

the other a shade of grey the brain will not properly 'pull' the stereo image into the middle and one of the red or green images will dominate.

This is where a facility like the RML 380Z's to 'mix' ones own 'shade' of red or green is very valuable. One then accepts whatever filters one can get hold of and fiddles with the colour mix. This is more elegant.

Wire frame models have been used so far as they do not involve the 'hidden line algorithm'. We now have a need for a hidden line algorithm in three dimensions before real objects can be shown. Who will try?

Although rotation of whole objects is slow it is possible to make a shape 'grow' an extension or 'arm' from a fixed base, and on my first example of the vertical pyramid I have had a small 'character' climb one of the sides 'out' of the screen — hurrah for the BBC's (and the 380Z's) programmable characters!

The ideal to aim for is to have a program which will ask for the coordinates of all corners of an object (or read them from disk if they have been pre-recorded) and a statement about how they are to be joined up and scaled along differing axes if necessary. The program should then request the required position of the object and the viewer and then procede to plot it on the image plane. This is still some way off as a general package for a wide class of objects.

Conclusion

The impact of seeing one's first stereo 'object' emerging from the screen is immense. I do encourage you to try. To whet the appetite, how about the following developments for the future?

Computerised chess with graphics-generated 3-D pieces (remember the horizontal screen/board in Fig 1).

'Star Trek' and similar games chasing Klingons 'through' the screen into the distance instead of across it.

'Adventure' type games in genuine 3-D mazes.

Maybe with machine code in a dedicated ROM these are not too far off!

On a more prosaic level, and with more educational content, how about:

'Contour' maps in geography.

Three-dimensional graphs in any setting.

Technical drawing projection work — make third angle projection drawings 'come to life'.

Three-dimensional geometry and trigonometry teaching.

This list is probably only scratching the surface but to deflate enthusiasm for the technique a little there is still a need for a convenient or quick way of projecting curved objects onto the screen. Circles are okay, but other curves are more difficult — or are they?

I would like to hear from readers who successfully try these techniques or extend them,.

```
10   REM 3-D PYRAMID P.W. STEVENSON
40   INPUT "PYRAMID HEIGHT (CM)" H
50   INPUT "LENGTH OF BASE (CM)" B
60   D = B*55/2
100  MODE 5
110  VDU 19,2,3,0,0,0
112  VDU 19,131,0,0,0,0
114  VDU 19,128,7,0,0,0
116  VDU 19,130,2,0,0,0
130  CLG
140  X = H * 40.11/(50 - H)
150  DL = 3 * X * 55/40.11
160  DU = 40 * X * 55/40.11
400  REM GREEN IMAGE TO RIGHT EYE
410  GCOL 0,2
420  MOVE 640 - D,0
430  DRAW 640 - D,2 * D
440  DRAW 640 + D,2 * D
450  DRAW 640 + D,0
460  DRAW 640 - D,0
470  DRAW 640 - DL,D + DU
480  DRAW 640 - D,2 * D
490  MOVE 640 + D,0
500  DRAW 640 - DL,D + DU
510  DRAW 640 + D,2 * D
650  REM  RED IMAGE TO LEFT EYE
655  DR = DL
660  GCOL 1,1
670  MOVE 640 - D,0
680  DRAW 640 - D,2 * D
690  DRAW 640 + D,2 * D
700  DRAW 640 + D,0
710  DRAW 640 - D,0
720  DRAW 640 + DR,D + DU
730  DRAW 640 - D,2 * D
740  MOVE 640 + D,0
750  DRAW 640 + DR,D + DU
760  DRAW 640 + D,2 * D
998  INPUT T$
999  GOTO 40
```

Fig 4.

Reference:- *Descriptive Geometry with 3-D Figures* Imre Pal, Hungarian Technical Publishers 1965.

END

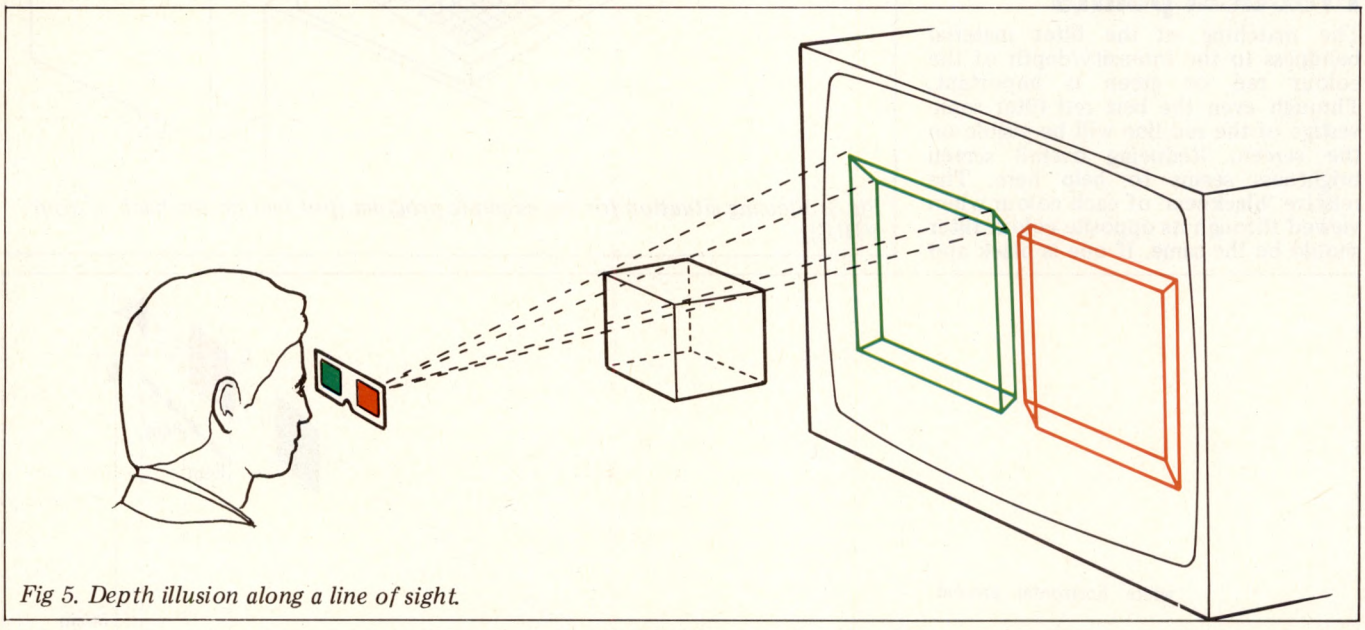


Fig 5. Depth illusion along a line of sight.

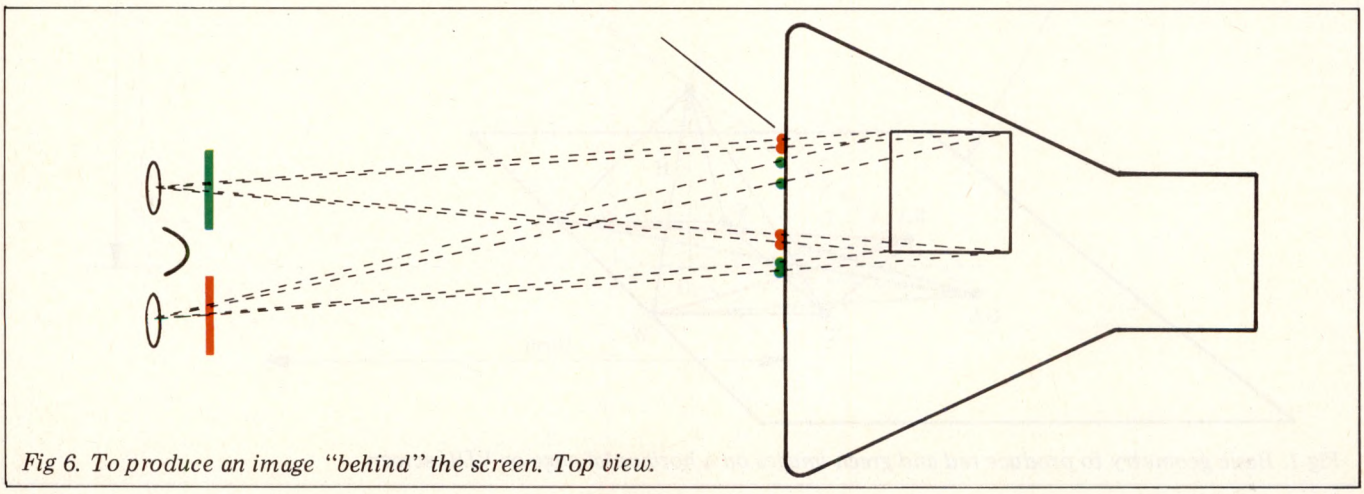


Fig 6. To produce an image "behind" the screen. Top view.

MAKING A HASH OF IT

Paul Overaa describes hashing, a fast file access method

In many applications it is necessary for sets of data items to be searched in order to rapidly locate an item or items of a specified value. Various approaches exist, including keeping indexes to locate the desired items, but this may require maintaining indexes of the key fields in sorted order so that techniques such as binary searching may be used. Although for some applications this is the best approach there are in many cases alternative solutions. One such alternative is known as 'key to address transformation' or 'hashing' and when used with care (ie, for suitable applications) it is possible to locate records in a fraction of the time that other methods will take.

In a general sense the problem is as follows: you wish to store data in such a way that given particular key fields you could retrieve other data items associated with the keys. As a concrete example, suppose you have a customer file containing records with the following fields or attributes:

CUSTOMER NAME
CUSTOMER ADDRESS
INVOICE ADDRESS
CREDIT STATUS
CURRENT CREDIT
DISCOUNT LEVEL

Given the customer name, you would wish to access the particular customer record in order to obtain the remaining details in the customer file. Let us suppose that it would be possible to find some 'rule' or 'function' that would turn the characters of each customer's name into a number each of which was unique and in the range of record numbers you had alloted for your customer file. The existence of such a rule or function would mean that given any customer name you would be able to compute the record number using only the rule. It would therefore be possible to store your records in locations that could subsequently be retrieved without any search at all simply by computing the location of the record from the customer name.

It is fairly obvious that in general no such rules exist, but if we relax the condition that our rules must produce unique numbers and instead be content with a situation where occasionally different keys will produce the same number then we are into the realm of hashing techniques or, as it is often called, key to address transformation techniques. When different keys result in the same hash value being computed then there is going to be a distinct probability that we will attempt to access a record that is not the one we require. Such occurences are termed 'collisions' and a discussion of how these are handled is important to the ideas that follow. If the hash function results in a collision then it is necessary to compute a 'second try' and maybe even further tries until the record we require is identified. In the worst possible case all records in the file would be examined before the correct record was located. Such occurences are extremely unlikely but. . . because it is possible at all it is necessary to make the following stipulation: any hashing rule used (and we now must include a method for calculating further locations to try in the event of collisions) must in the worst possible case be able to access every possible location available in the file. The frequency of collisions is related to the number of 'used' records in the file. It is a common practice to allocate some 20% more file space than an application requires since this helps to ensure that collisions are kept to an acceptable level.

Addition of data records would use the same rules and would search for the first location that was empty — ie, if the hash function located a record that contained data, then a second try, etc, would be made until an empty record was located. The new data would then be stored at this position in the file.

Circular files

The concept of a circular file is crucial to the approach I shall use to develop my ideas. I want you to imagine that the computer file is wrapped around a circle with the records of the file spread evenly around the circumference and that possible record numbers range from zero to (N-1).

Those that have studied any modern mathematics will appreciate the connection of my approach with the concept of 'clock arithmetic' — ie, arithmetic modulo N where N is the number of records in our 'Circular File'.

Our problems are as follows:

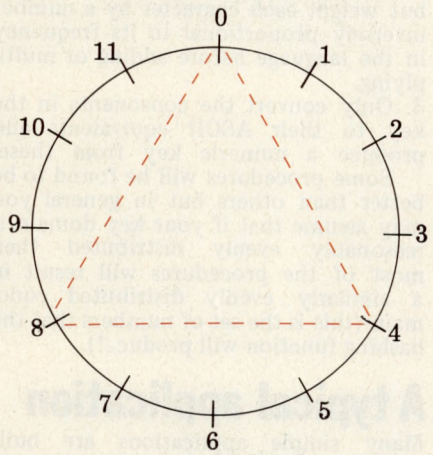
1. We require a rule that enables a record number to be calculated and a further rule that enables additional 'tries' to be calculated.
2. The rules must in the worst possible cases be able to search the whole of our circular file.
3. The rules must attempt, as far as possible, to distribute the data we store evently around our circular file otherwise there will be increased chances of collisions which will increase the time required to access a required record.

The most serious immediate problem is 2 — ie, how can we be sure that our circular file will be searched completely by any rule we could use? We could examine critically every rule that we invent and this approach has been used many times (it frequently results in some quite frightening mathematics) or we can make certain restrictions that will enable us to prove that in the worst cases we are in fact able to search the complete file.

The restrictions that I make are as follows:

1. Our hashing rules must produce two numbers, the first of which lies between zero and (N-1) and the second between 1 and (N-1) where N is the number of record positions in the circular file we are using.
2. The first number is used as the initial attempt value and the second number is used to 'step round' the file using a fixed step-length.
3. The size of the circular file is such that it contains N record positions where N is a prime number, ie, contains no factors other than unity or N itself.

The stipulation of N having to be a prime number enables us to state that any non-zero step length that is less than N will result in every location of the file being examined in the worst possible case. The proof of this is fairly straightforward and has an important corollary. . . namely that if you do not use a prime number sized file and the 'step-length' calculated has a common factor with your file size N then it will be impossible to search the file completely. To appreciate this image stepping around a file of twelve records using steps of 2,3,4,5,8,9 or 10 all of which have common factors with 12 and all of which will fail to search all of the 12 possible records.



Note: A step length of 4 results in only three records being examined irrespective of how many times we step around the circular file.

MAKING A HASH OF IT

The calculation of a non zero step-length less than N provides a solution also to the problem of uneven distribution within the file since even if the initial record number produces a collision with another record it would be necessary for the keys to produce identical step lengths as well as before the same path would be followed for more than the first attempt.

At this time a rather important point to be made is that most computer systems do not allow zero as a valid record number. The solution in practice is simply to ensure that computed values are incremented by one, thus avoiding zero values.

Numeric Keys. . . here the problem is relatively straightforward. Suitable functions will depend on the range of values the keys will cover. A single example should indicate a typical method of solution.

The keys are stock numbers ranging from 00100 to 45200. There are approximately 600 different stock items and the wider range of stock numbers is the result of the numbers including check digits, storage area codes and spaces for further stock items.

In this case we could use a file size of say N = 997 and would define variables as follows:

Q = INT (STOCK NUMBER/N)
ENTRY POINT = INT(STOCK NUMBER − (N*Q))+1
STEP LENGTH = Q MOD(N−1) +1

Note that our definition of entry point ensures that we will obtain a number between 1 nad N similarly the definition of step length ensures a number usually different to the entry point and it will be between 1 and (N-1). (The above type of formula is very common and is able to produce good results in many cases.)

Alphanumeric/alphabetic keys. . . the additional problem is to convert characters into a pure number form before using an approach as for numeric keys. Some methods that may be used are as follows:

1. Convert each character of the key into the ASCII code equivalent then add or multiply them together.
2. Convert to ASCII code as in 1 above but weight each character by a number inversely proportional to its frequency in the language before adding or multiplying.
3. Only convert the consonants in the key to their ASCII equivalents and produce a numeric key from these.

Some procedures will be found to be better than others but in general you may assume that if your key domain is reasonably evenly distributed then most of the procedures will result in a similarly evenly distributed codomain (this is the set of numbers that the hashing function will produce!).

A typical application

Many simple applications are built around the three basic functions of addition of a record, deletion of a record and searching for a particular record. The example I have chosen was written to illustrate these functions in use is an 'address book' program. The idea being that you create records consisting of a name, two lines of address and a telephone number. The program enables you to locate these details using the name field only. The example is somewhat contrived but it does illustrate the basic ideas involved. Written in Microsoft's Basic 80 using a Rair Black Box/Hazeltine terminal system the program has the following layout:

A 'Begin Block' performs the setting up of variables and opening of a file. Variable N% defines the size of the file and can be altered to suit requirements. Two user defined functions are used: CLEARFROM$(X) is used to clear the Hazeltine screen from line X downwards.

CUR$(X,Y) is used to position the cursor of the Hazeltine terminal. The cursor co-ordinates are supplied as column X (which may be between 0 and 79) and line Y (which may be between 0 and 23).

An 'Option Select' block enables the user to add, delete or retrieve data and to initialise the file by writing blank records. This block operates by selecting a subroutine based on the value of the option number selected. Files should be initialised before use since the program identifies unused records as those whose fields contain strings of blank characters.

Two subroutines called 'compute hash values' and 'compute rehash' respectively are used to perform the hashing functions. The name (the key field in this example) is converted to a numeric value which is the sum of the ASCII values of all the characters present. This field is brought to 20 characters in length so that proper comparison may be made with the name field retrieved from the random access file which will be 20 characters in length as defined in the FIELD statement (line 5010). The rehash subroutine increments the last record number calculated by the step length and line 4200 guarantees that we step around our

```
2 REM ================================================================================
3 REM          B E G I N  -  B L O C K
4 REM --------------------------------------------------------------------------------
5 CLEAR
8 N%=113' IMPORTANT ----------------> User must set N% to a suitable PRIME NUMBER
10 DIM ADDRESS.LINE$(4),RECORD.LINE$(4),FIELD.NAME$(4),SELECTION$(4)
11 SELECTION$(0)="File full - cannot complete operations":SELECTION$(1)="Addition complete":
       SELECTION$(2)="Retrieval complete":SELECTION$(3)="Record deleted if key existed":
       SELECTION$(4)="All data erased - new file now available"
12 FIELD.NAME$(1)="Name":FIELD.NAME$(2)="First line of address"
13 FIELD.NAME$(3)="Second line of address":FIELD.NAME$(4)="Telephone number"
14 DEF FN CUR$(X%,Y%)=CHR$(126)+CHR$(17)+CHR$(X%+96-96*INT((SGN(X%-30)+1)/2))+CHR$(Y%+96)
15 DEF FN CLEARFROM$(X%)=CHR$(126)+CHR$(17)+CHR$(96)+CHR$(X%+96)+CHR$(126)+CHR$(24)
20 GOSUB 5000'open files
22 REM ================================================================================
23 REM          O P T I O N  -  S E L E C T I O N  -  B L O C K
24 REM --------------------------------------------------------------------------------
25 WHILE X%-5
30 PRINT FN CLEARFROM$(0)
40 PRINT FN CUR$(0,0);"1: Add"
50 PRINT FN CUR$(9,0);"2: Search"
60 PRINT FN CUR$(24,0);"3: Delete"
70 PRINT FN CUR$(38,0);"4: Clear"
75 PRINT FN CUR$(49,0);"5: End"
80 PRINT FN CUR$(60,0);"Which option ";:INPUT X%
85 ATTEMPTS%=0
90 ON X% GOSUB 1000,2000,3000,6000,150
92 PRINT FN CUR$(10,20);"Number of hash attempts required  ";ATTEMPTS%
95 PRINT FN CUR$(10,22);SELECTION$(X%);" press RETURN to continue";:X$=INPUT$(1)
100 WEND
130 REM ================================================================================
140 REM          E N D  -  B L O C K
145 REM --------------------------------------------------------------------------------
150 END' ------------> This is the logical end of the program
970 REM ================================================================================
980 REM          A D D I T I O N  -  O F  -  D A T A  -  S U B R O U T I N E
990 REM --------------------------------------------------------------------------------
1000 PRINT FN CLEARFROM$(8);:
1005 GOSUB 4500'Input routine
1010 GOSUB 4000'compute initial hash values
1020 WHILE RECORD.LINE$(1)<>STRING$(20,32) AND RECORD.LINE$(1)<>STRING$(20,ASC("*")) AND ATTEMPTS%<N%
1030 GOSUB 4200'compute rehashes until empty record is found
1040 WEND
1050 IF RECORD.LINE$(1)=STRING$(20,32) OR RECORD.LINE$(1)=STRING$(20,ASC("*")) THEN GOSUB 4900
       ELSE X%=0'store data if there is space otherwise prepare to give file full message
1060 RETURN
1970 REM ================================================================================
1980 REM          R E T R I E V E  -  D A T A  -  S U B R O U T I N E
1990 REM --------------------------------------------------------------------------------
2000 PRINT FN CLEARFROM$(8)
2010 GOSUB 4600'input search key subroutine
2015 GOSUB 4000'compute initial hash values
2020 WHILE RECORD.LINE$(1)<>ADDRESS.LINE$(1) AND RECORD.LINE$(1)<>STRING$(20,32) AND ATTEMPTS%<N%
2030 GOSUB 4200'compute rehashes until correct record is found
2040 WEND
2050 IF ADDRESS.LINE$(1)=RECORD.LINE$(1) THEN GOSUB 4800
       ELSE PRINT FN CUR$(10,18);"This record does not exist - request has been ignored"
2060 RETURN
2970 REM ================================================================================
```

```
2980 REM       D E L E T E  -  D A T A  -  S U B R O U T I N E
2990 REM ------------------------------------------------------------------------
3000 GOSUB 2000'we use the retrieve data option block to locate the record !!
3020 IF ADDRESS.LINE$(1)=RECORD.LINE$(1) THEN ADDRESS.LINE$(1)=STRING$(20,ASC("*")):
       GOSUB 4900'replace record with asterisks to indicate deletion if record exists
3040 RETURN
3970 REM ========================================================================
3980 REM       C O M P U T E  -  H A S H  -V A L U E S  -  S U B R O U T I N E
3990 REM ------------------------------------------------------------------------
4000 SUM%=0:FOR I%=1 TO 20:SUM%=SUM%+ASC(MID$(ADDRESS.LINE$(1),I%,1)):NEXT I%
4010 Q%=INT(SUM%/N%)
4020 ENTRY.POINT%=INT(SUM%-N%*Q%)+1
4030 STEP.LENGTH%=Q% MOD(N%-1)+1
4040 RECORD%=ENTRY.POINT%
4045 GET #1,RECORD%
4047 ATTEMPTS%=1
4050 RETURN
4060 REM ========================================================================
4180 REM       C O M P U T E  -  R E H A S H  -  S U B R O U T I N E
4190 REM ------------------------------------------------------------------------
4200 RECORD%=(RECORD%+STEP.LENGTH%-1)MOD(N%)+1'must keep within file number range !!
4210 GET #1,RECORD%
4215 ATTEMPTS%=ATTEMPTS%+1
4220 RETURN
4480 REM ========================================================================
4490 REM       I N P U T  -  S U B R O U T I N E  -  A
4495 REM ------------------------------------------------------------------------
4500 FOR I%=1 TO 4:PRINT FN CUR$(10,6+2*I%);FIELD.NAME$(I%);FN CUR$(40,6+2*I%);" ";:
       ADDRESS.LINE$(I%)="":LINE INPUT ADDRESS.LINE$(I%):PRINT:NEXT I%
4510 ADDRESS.LINE$(1)=ADDRESS.LINE$(1)+STRING$(20-LEN(ADDRESS.LINE$(1)),32)
4520 RETURN
4550 REM ========================================================================
4580 REM       I N P U T  -  S U B R O U T I N E  -  B
4590 REM ------------------------------------------------------------------------
4600 PRINT FN CUR$(10,8);FIELD.NAME$(1);FN CUR$(40,8);" ";:ADDRESS.LINE$(1)="":LINE INPUT ADDRESS.LINE$(1)
4605 ADDRESS.LINE$(1)=ADDRESS.LINE$(1)+STRING$(20-LEN(ADDRESS.LINE$(1)),32)
4610 RETURN
4770 REM ========================================================================
4780 REM       D I P L A Y  -  R E C O R D  -  D E T A I L S  -  S U B R O U T I N E
4790 REM ------------------------------------------------------------------------
4800 REM
4810 FOR I%=2 TO 4:PRINT FN CUR$(10,6+2*I%);FIELD.NAME$(I%);FN CUR$(40,6+2*I%)" ";RECORD.LINE$(I%):NEXT I%
4820 RETURN
4870 REM ========================================================================
4880 REM       S T O R E  -  D A T A  -S U B R O U T I N E
4890 REM ------------------------------------------------------------------------
4900 FOR I%=1 TO 4:LSET RECORD.LINE$(I%)=ADDRESS.LINE$(I%):NEXT I%:PUT #1,RECORD%:RETURN
4970 REM ========================================================================
4980 REM       O P E N  -  F I L E S  -  S U B R O U T I N E
4990 REM ------------------------------------------------------------------------
5000 OPEN"R",1,"MASTER"
5010 FIELD #1,20 AS RECORD.LINE$(1),30 AS RECORD.LINE$(2),30 AS RECORD.LINE$(3),18 AS RECORD.LINE$(4)
5020 RETURN
5030 REM ========================================================================
5980 REM       C L E A R  -  F I L E  -  S U B R O U T I N E
5990 REM ------------------------------------------------------------------------
6000 FOR I%=1 TO 4:LSET RECORD.LINE$(I%)="":NEXT I%
6010 FOR I%=1 TO N%:PUT #1,I%:NEXT I%
6020 RETURN
6030 REM ========================================================================
```

'circular file' in uniform steps. The variable ATTEMPTS% keeps track of the number of attempts that have to be made to locate the record and also serves to indicate when the file is full. When the file is full (ie, when the number of attempts equals the file size) the selection variable X% is set to zero to cause a file full message to be printed.

'Addition of data' is accomplished by collecting data with an input subroutine, computing the initial hash values for variables ENTRY.POINT% and STEP.LENGTH% and then stepping around the file using a WHILE/WEND loop until an empty record is found. Option 4 must be used initially to set up the data file by writing blank records. Once an empty record is found (or once all records have been looked at without finding any empty record) the loop is left and if there is available space the new data is stored.

'Retrieval' is performed by collecting the name to be searched for with the second input routine, computing the initial hash values as before and then performing a 'step-around' search using a WHILE/WEND loop as before. In this case the exit condition is based on three points:

First we may find a key match, ie, we have located required record. Secondly we may reach an empty record, in which case we will have searched all positions where the required record would have been placed. Thirdly we may have looked at all records in the file.

If the record has been located it is displayed by calling a 'Display Record Details' subroutine 4800 otherwise a 'does not exist' message is printed.

'Deletion' is accomplished by setting the name field of the record to a string of asterisks. The effect is to flag the particular record as deleted. Deletion is one of the areas that can provide difficulties since it is not normally appropriate to simply remove the details from the key field. If this were done then the deleted record would appear to be the 'end of the chain' as it were and the hashing search when reaching such a record would not look any further. This would cause improper searching and so a common solution is to set the key field to some arrangement of characters that can identify the record as being deleted rather than empty. The addition of data routine recognises deleted records by the fact that the key field, ie, the name field, has been set to a string of asterisks.

The remainder of the subroutines used are titled according to their function — eg, 'Open Files', 'Store Data' — and since each one has only two or three lines they should be self-explanatory. You will notice that I keep the individual parts of the program isolated by REM statements which include titles. This helps to split the program up into small units that are more easily understood. I tend also to treat these blocks as subroutines which are called as and when desired. This facilitates alterations, etc, and creates a more readable program. As an example, suppose you wish to change the way the initial hash values are calculated. The subroutine is identified easily by its title 'Compute hash values' and since it has only a few lines of code (which you will note could be written considerably more concisely than I have done for this example) it would only take a short time to understand what the subroutine is doing.

With properly designed screen layouts and the addition of input validation subroutines the program can be used for applications such as a 'computer diary', an 'attribute file', etc, but as a parting thought you may like to consider the following possibility:

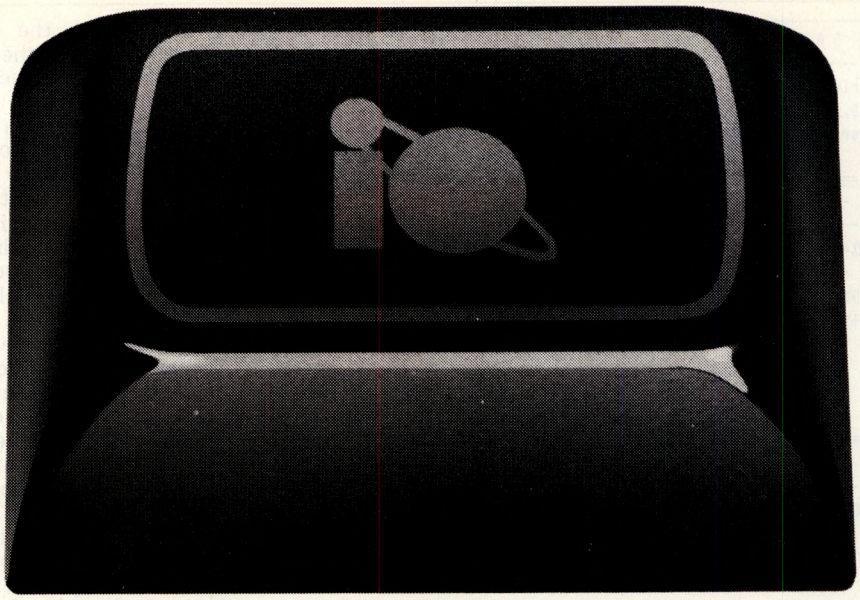
An estate agents 'House for sale' file consists of houses that are classified by:

1. Cost Range eg, 10,000-14,999 : 15,000-19,999, etc.
2. Number of bedrooms.
3. Location with geographical areas being coded, say, using the postal code.

If a file was set up that used hash techniques to locate items based on a key produced from the three attributes mentioned and if, instead of storing the data in this file, you regard it as a directory with the file containing pointers to the heads of chains of 'linked' records then we produce what is termed a hashed access multilist directory.

All properties with the same 'attributes' are stored in chained form — ie, each record contains the record number of the next record in the chain. A search for 'all available property in area SS41TD with four bedrooms and in the price range 45,000-49,999' can become virtually instantaneous. The three attributes produce a key that is hashed to rapidly find the 'head' of the chain records with these attributes and then all available property satisfying the criteria given can be retrieved with no further searching required at all.

It is difficult to do justice to any technique in an introductory article of this nature. I have illustrated the approach that I have developed but obviously there are an enormous number of other approaches. Once the basic ideas are understood the transition to more sophisticated applications becomes easier. In the end we are limited only by our own ingenuity. **END**



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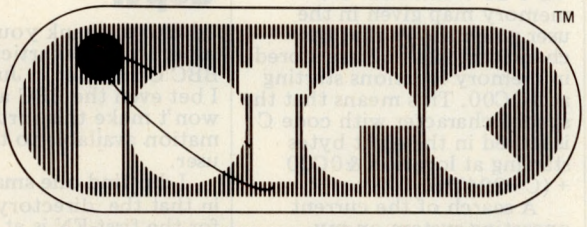

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COMMUNICATIONS

PCW welcomes correspondence from its readers but we must warn that it tends to be one way! Please be as brief as possible and add 'not for publication' if your letter is to be kept private. Please note that we are unable to give advice about the purchase of computers or other hardware/software — these questions must be addressed to Sheridan Williams (see 'Computer Answers' page). Address letters to: 'Communications', Personal Computer World, 62 Oxford Street, London W1A 2HG

Beeb characters

I read with interest the article by M Howlett in the July issue on a Character Generator for the BBC Computer, and would like to make some comments. A number of aspects lead me to suspect that the program may have been converted from another micro as some of the more useful features of the BBC machine have not been exploited.

The choice of the non-graphics Mode 6 seems rather strange since a proper 8x8 grid cannot then be drawn. Further, two colours only are available, despite references in the program to COLOUR 0, COLOUR 3 and COLOUR 5. To draw and fill a grid, at least three colours are desirable. The use of a graphics mode, selected by the user, would seem preferable, and this has the added advantage of drawing the character as it looks in that mode — ie, double width in modes 2 or 5, but only half-width in mode 0.

A more important point, since it has a variety of applications, is to note that it is possible to use the cursor control keys in program mode. Typing *FX 4 1 at the beginning of the program enables the keys (*FX 4 0 converts the keys back to their usual editing functions). The keys then generate ASCII codes 136 to 139, and GET or INKEY can be used to detect if they have been pressed. These keys, together with DELETE (code 127) and COPY (code 135), give a rather simpler and more natural way of moving around the grid and filling or deleting squares.

It may be of interest to show how to reverse the logic of the program and draw large characters when given the eight bytes required by the VDU 23 command. The memory map given in the user guide shows that the characters 224-255 are stored in memory locations starting at &0C00. This means that the special character with code C is stored in the eight bytes starting at location &0C00 + (C—224)*8.

A search of the current operating system on my machine (Eprom 0.10, Model B) shows that the VDU codes for keyboard characters are equally accessible. Characters 32 onwards are stored at the beginning, ie, from &C000. Thus the character with ASCII code C is stored at &C000 + (C—32)*8. The following program segment uses the VDU codes to draw large characters, and could form the basis of a 'Bigprint' routine. The same variables are used as are given in the article; a free-standing program would need to declare arrays, etc.

```
1000 MODE 4: NUM=1
1010 INPUT "TYPE 1 FOR
     A KEYBOARD CHAR-
     ACTER OR 2 FOR A
     PREVIOUSLY SAVED
     SPECIAL CHARAC-
     TER "N
1020 IF N=2 THEN INPUT
     "CODE", C ELSE IF
     N=1 THEN INPUT
     "CHARACTER", C$
     :C=ASC(C$) ELSE
     END
1030 IF C 223 AND C 256
     THEN STORE=&0C00
     +(C—224)*8—1
     ELSE IF C 31 AND
     C 127 THEN STORE=
     &C000+(C—32)*8—1
     ELSE END
1040 FOR A=1 TO 8
1050 C1(NUM,A)=?(STORE
     +A)
1060 W=128
1070 FOR B=1 TO 8
1080 IF C1(NUM,A) AND W
     THEN PRINT CHR$
     (224); ELSE PRINT
     " ";
1090 W=W/2
1100 NEXT B
1110 PRINT
1120 NEXT A
```

The ? at line 1050 is the BBC Basic for PEEKing the memory location, and the logical AND at line 1080 is used to decide if the particular bit in the byte is 0 or 1.

P Whitworth, Lewes

See also 'Beeb Character Generator' in this issue's TJ's Workshop — Ed.

Back-patting dept.

I'd like to thank you for a superbly useful article on the BBC Computer in July's *PCW*. I bet even the BBC and Acorn won't make this sort of information available to the general user.

I did find one small fault in that the directory address for the first FN is at &04F8,9 and the PROCs at &04F6,7 — not the other way round.

There are far too few articles of this type in the consumer magazines these days and thumbing through issues of *PCW* for '78 and '79 the other day I noted the pioneering interest that was created. Keep up the good work.

Colin Chatfield, Camborne

One-liner

Here is another of those one-liners for a Tandy or Video Genie: this one is for Biorhythm and sine wave freaks!

```
0 X=X+ .25: FOR Y=1 TO
6: POKE SIN(X/Y)*32+
16288, Y+48: NEXT: PRINT:
GOTO
```

Points to mention are that GOTO without a line number goes to line zero, and that memory location 16288 is the middle of the bottom line of the screen.

B E Newsam, Sheffield

Out of the frying pan...

With considerable assistance from the Advertising Standards Authority I finally managed to get delivery of a Sinclair Spectrum in a time approximating to the 'up to 28 days for delivery' of the Sinclair ads.

It was faulty. Tuning to a TV (I tried three Sonys) was very critical and colour was lost, at first intermittently then completely, after about ½ - 1 hour's use.

I would have taken a chance and exchanged it for another, but the two weeks quoted for this (in which I have little faith), together with the attitude of the Sinclair staff at Camberley and Cambridge (particularly the 'Customer Relations' manager at Cambridge) have persuaded me to ask for a refund and buy a BBC Computer.

I feel that back-up and customer relations are important, especially when related to complex devices. Perhaps the BBC was wise in not going to Sinclair.

A Deacock, London W1

Several thousand would-be BBC owners might dispute your last statement, Mr Deacock — Ed.

Spectrum of woes

After waiting eight weeks to receive a 16k ZX Spectrum I found that when the colour was used the characters shimmered, making them difficult to read. I phoned Sinclair and they told me to return the computer: this I did.

Two weeks later I had heard nothing, so I phoned to make enquiries. I was asked by the telephone operator at Sinclair if I had received a card from them — to which I replied 'no'. She then told me that she could give me no information until I had received a card.

A few days later the card arrived, and so I phoned Sinclair, quoting the reference number on the card. I was told by the operator that although I had received the card and quoted the reference number she could not find out any information. She assured me that because I had the card my computer was soon to be dealt with, and I should phone back in a few more days; this I did.

My third call was to bear some fruit. After taking my name and reference number, the operator told me that my Spectrum was nearing the top of the pile and would soon be dealt with. I thanked her, breathed a sigh of relief and waited — two more weeks.

It was now five weeks since I had sent my Spectrum back and, feeling a little annoyed, I phoned Sinclair, gave my name and reference number to the operator and waited. I was told very politely that my computer was nearing the top of the pile. I told the operator, also politely, that this was unacceptable and asked to talk to the manager of the service department. I was then put on to someone who said she was the supervisor.

I explained my case to her, only to be told that my computer was working its way to the top of the pile. I then asked for an immediate replacement. She refused this request, saying that because of delays in despatching new machines, and of course the infamous design fault, she had been instructed by management that no immediate replacements would be possible. But she said that she might be able to rush things along in a few weeks.

I then asked to talk to the management who had given her these instructions. She said she had no access to them and, therefore, nor had I. I was forced to ask for a full refund, which she immediately agreed to.

I may now never take up the hobby of home computing because at the moment there is no comparable machine to the Spectrum in price and function. But if Clive Sinclair thinks he can use this fact to keep his customers happy and loyal to his company then he is sadly mistaken, and his company does not deserve to prosper.

As you may have gathered by now, I am not a very happy person. This sort of bad service does not only reflect on Sinclair, which doesn't seem to care anyway, but it also tends to reflect on British companies as a whole as opposed to Japanese companies who have always given me excellent after-sales service — ie, Vivitar UK and Pioneer UK. If this sort of experience is widespread it must also affect the sales of your magazine.

I have sent a copy of this letter to Mr Sinclair in the hope that it may help other customers and in turn Sinclair itself in the future.
Keith Allen, London SE17

These are just two of many letters on this theme. Below we publish Clive Sinclair's reply. We also have a mountain of BBC Computer complaints which we can't print; it just gets too repetitious. . . Ed.

Uncle Clive replies

In response to the many queries which, I understand, *PCW* has received, I would like to personally explain the current delivery situation for our new ZX Spectrum personal computer.

The general public's response to our new computer has far exceeded our expectations and we have been swamped with orders. This and some small initial production delays have led in turn to considerable delays in delivery.

Regrettably, many of our customers may have to wait up to 12 weeks, from our receipt of their order, for delivery of their Spectrum and we are writing to them all to apologise for the inconvenience and to offer them the chance of an immediate refund.

For those customers who continue to wait, we shall be sending out with each Spectrum, in compensation for the delay, a £10 voucher which can be used in part-payment for a ZX printer or to buy a complete pack of five rolls of printer paper.

We are also providing customers with a new demonstration tape containing:
1. A complete 'keyboard trainer' to introduce the Spectrum.
2. Three major programs — an exciting game, Through the Wall; a drafting program, Draw; and Character Generator, which demonstrates user-defined graphics.
3. A series of illustrative programs — Bubble Sort, Evolution, Life, Monte Carlo, and Waves.

Finally, I would like to assure you and all our customers that the initial problems with the Spectrum have now been completely overcome. Production is running smoothly at 5000 units per week and will rise sharply over the coming months. We are confident that our present backlog will be cleared by the end of September and hope that you will see current delays in the context of our successful delivery of more than 500,000 computers in the last two years.
Clive Sinclair, Sinclair Research Ltd

DeVALuation

Poring over the August issue of *PCW* I came across a letter in Communications which commented on the use of VAL for function evaluation. Upon reading the editorial comment, my eyebrows scuttled up over the back of my head. Can I really have owned my Texas 99/4 for two years and missed this use of VAL? I check and, no, I haven't missed a thing. The function of VAL which you ascribe to the Texas does not exist (unless you were thinking of the Equation Calculator, unique to the 99/4, and totally devoid of programmability), neither is it implemented in the new version 110 Extended Basic.

I have often felt the need for VAL on my TI to really represent the counterpart of STR$, and I have written in the user group newsletter bemoaning this fact. As it appears that some people have bought computers believing them capable of functions of which they are not capable (myself included), in the interests of accuracy can I ask you to correct your misleading comment? It has been bad enough coping with the many inaccurate reviews of the Texas machines without having to explain to disappointed new owners that their latest purchase can't do the things that even some ads claimed they could.

I feel particularly strongly about this as I bought my 99/4 (£1000 in those days) in the mistaken belief that the PLOT and DRAW commands were available (based on an advertisement that claimed you could plot to 192 x 256 individually addressable screen points) and the irritation was compounded, and is still being compounded, by the lack of machine code programming — and buying the Extended Basic won't do you a ha'porth of good as the machine language subprograms function only when the 32k (and there's a story behind that one, too) £300 Expansion Memory is used. Even worse, there is a mini-memory and an assembler/editor module available; the latter runs only with disks, and it is rumoured that a rewire of the 99/4 may be necessary in order to use either module.
Peter Brooks, Oxford

Fuller praise

Outraged shouts about British companies are pretty commonplace — here's a nice story for a change!

In March I ordered a keyboard, case and power supply for my ZX81 from Fuller Microsystems of Liverpool. We are not blessed with the best surface mail in the world and so after it hadn't arrived in July I was getting a bit cross. I'll wait for the next boat, I thought, and it did come in August. However, the letter enclosed with it from Bob Rylands made it clear that my order had been mislaid and as mine was an unusual request they had then made up the order especially. They were all very sorry. I'll be dealing with them again! Expatriates often get a raw deal from companies in the UK. When I return I'll be hoping to set up an export agency dealing in systems and peripherals for expats. Fuller Microsystems would be the sort of supplier I would approach.

Needless to say, I'm not connected with them, etc, etc.
Ned Abell, Ascension Island, South Atlantic Ocean

((Down (with (brackets))))

Many thanks for printing Michael Liardet's excellent article on Lisp. This looks like a really powerful language, quite easy to learn and a lot more fun than Pascal. The only unattractive feature for the micro enthusiast is the extent of the use of nested brackets. These are a hassle to use and a bore to check. But have you noticed? They are also entirely unnecessary! In fact, the notation used by Lisp (prefixed dyadic operators) was invented just to dispense with the need for nested punctuation.

Mr Liardet's first example of Lisp code can be written out, omitting the brackets, like this:

```
COND
   OR
      EQ
         PLUS A B
         2
      LESSP
         TIMES C D
         5
   SETQ
      E
      MINUS C D
```

Here indentation is used to show the structure of the conditional, eg, the arguments of 'COND' are 'OR' and 'SETQ'; those of 'OR' are 'EQ' and 'LESSP', etc. This too is dispensable from the compiler/interpreter's standpoint. The whole conditional could be written as a single line of code, and, if the reserved words were 'tokenised', this would slightly *decrease* execution time compared with the bracket-ridden version.

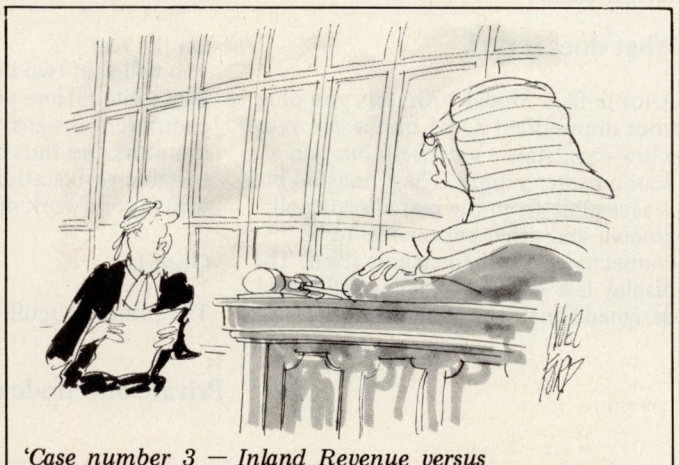
The ideal solution is: make brackets optional, on input and on listing. The usual restriction on variable names, that they should contain no spaces, is enough to avoid ambiguity.
John M Kerr, Glasgow

This works fine for dyadic operators, but the brackets in Lisp are primarily intended to delimit lists. How do you show a list of lists of lists without them? — Ed.

Video doctor

First of all I want to congratulate you on producing a consistently excellent magazine. I am by no means an expert in microcomputing but it never fails to stimulate my interest and is educational without being taxing.

I am interested in adapting a video-disc system as a medical encyclopaedia for use in doctors' surgeries, and would be very grateful if any of your readers would be able to supply me with information about current developments in this field.
Walter Mrozinski, 28 Lower Park Road, Victoria Park, Manchester 14.



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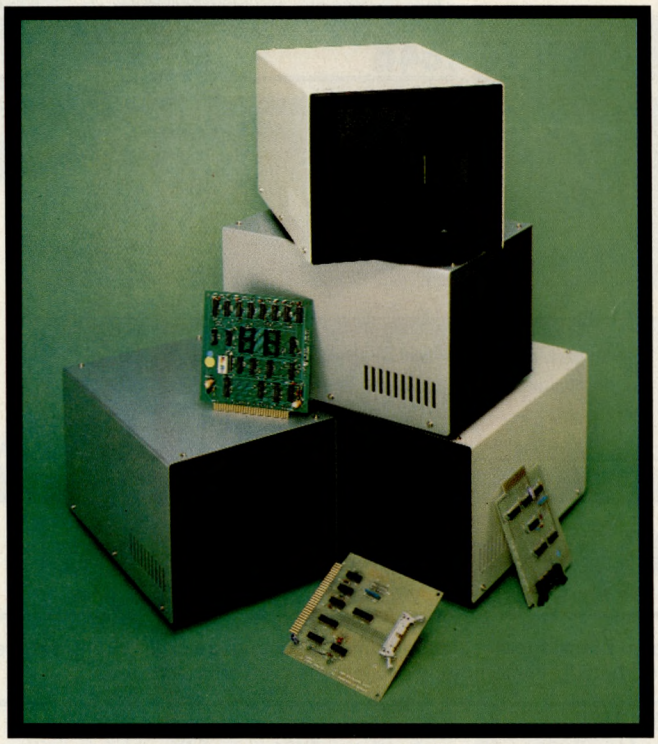

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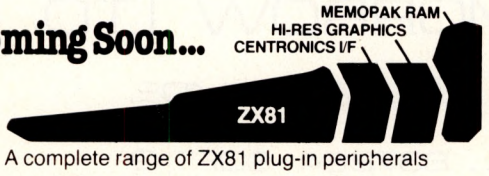

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DATA DABBLING

A MULTI-FILE DATABASE SYSTEM

J A B Leeser describes how he wrote his own UCSD Pascal relational database system.

The idea of writing a type of relational database system for a microcomputer was born just prior to my arrival in Brazil. By this time I felt that I had sufficient mastery of Pascal (UCSD), had done some preliminary studies on tree structures and written a general routine for the binary search of an array — the last two without any specific objective in mind.

My interest in relational databases had been stimulated some three years before by V Nederhof, of UIMC BV, Rotterdam, who had lent me C J Date's *An Introduction to Database Systems.* A time of much travelling and too little home life intervened, but the conviction that the relational approach ought to offer the simplest solution to retrieving information from structured data had stayed with me. Once settled in our new home, I resolved to use what little spare time I had to write the index-driven database system for a micro.

Overall structure

The decision to use only standard Pascal data structures was made at an early stage. Next, the central database subsystem had to be built on a data file structure, consisting of records with a number of header fields followed by ten general-purpose string fields meant to contain the main data. Clearly, this general structure had to be given a specific form to reflect a particular data file. Thus it had to be associated with a format derived from a format, or Data Dictionary sub-system. On the other hand, data files were to be manipulated by means of indexes. Thus an index subsystem was required, leading into some form of output system to provide results. Connecting these sub-systems by a menu, the overall structure of DABS, as it came to be called, is shown in Fig 1.

This structure turned out to be adequate in the end and is described in more detail below.

Data dictionary subsystem

The Data Dictionary subsystem consists of three main functions, effectively three programs, which may be represented as in Fig 2.

The first task is to create a format file (when necessary) to insert records carrying file and field names and to delete unwanted records. The second is to create an inverted file listing field names of all records in alphabetic order, giving the appropriate file name. Both these functions use binary tree structures (B trees) for sorting in main memory. The third function lists either file on the printer.

The file name of the appropriate format record is a prerequisite for operating with a particular data file. The field names held in the format file define the data file fields. Thus no data file operation can take place unless a format record for that data file exists. The alphabetic list of field names is included as a very simple reference to

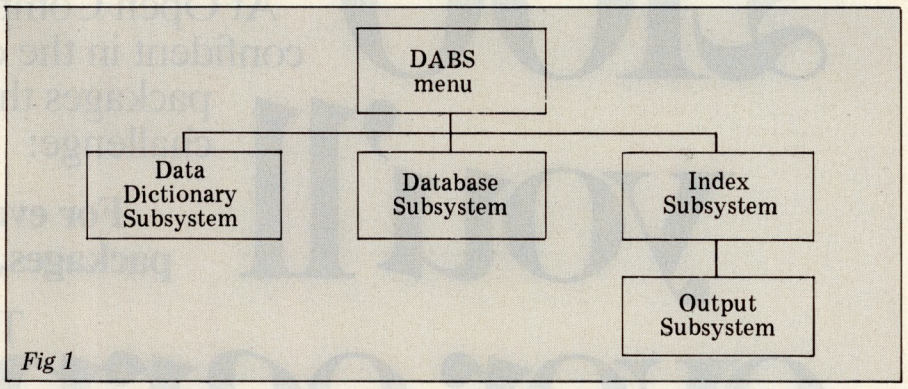

Fig 1

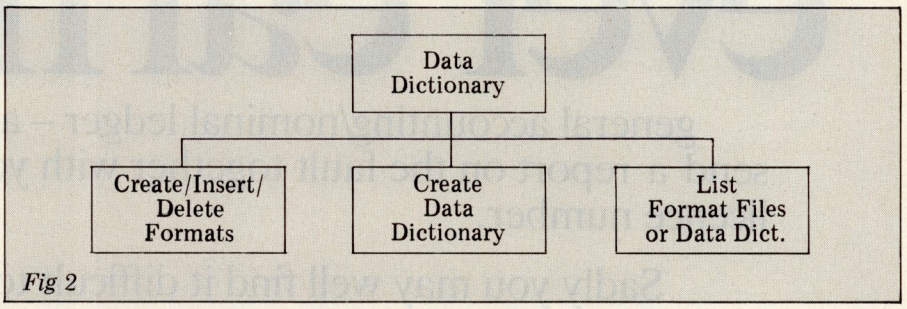

Fig 2

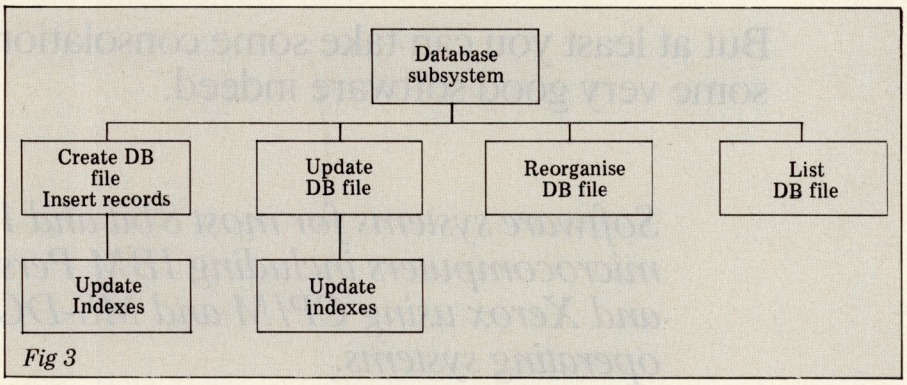

Fig 3

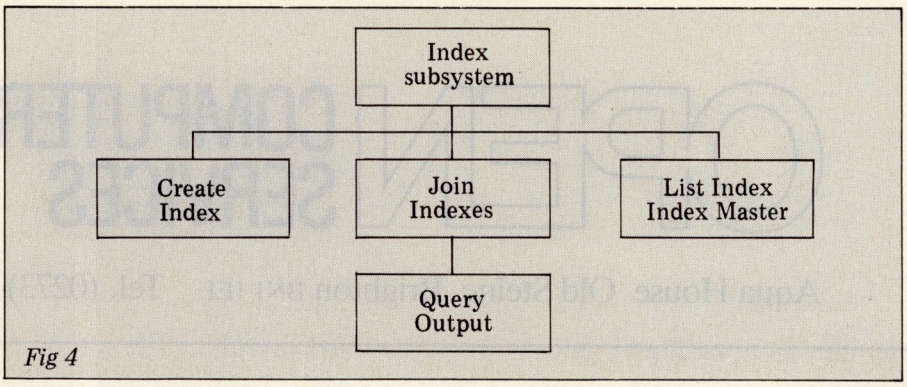

Fig 4

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DATA DABBLING

field names and where they are used, but is of no further importance in the system as a whole.

Database subsystem

The Database subsystem's functions are: to create files and insert records, to update fields of all or specific records (including deletion of records), to reorganise files and to list them, as depicted in Fig 3.

It will be noted that both the Create/Insert function and the Update function automatically update all indexes related to the data file, at least in all those cases where they exist, having been created in the first place by the Index sub-system (an index is a file holding records or elements of key fields and the relevant data file record numbers, ordered in key field sequence and, optionally, obeying specifiable selection criteria). Thus an index will always reflect the correct state of the data file within the rules relevant to the original definition of that index (its 'scope').

The Update function is itself controlled by an index. It permits changing one or more fields, including the status field, over the scope of the index and offers the choice of a 'global' or a record-by-record update. The status field has either the value L(ive) or the value D(ead). Dead records are intended to be deleted by the Reorganisation function and, pending this final decision, are ignored by the system.

The index system

Just as the format file record is essential to the creation, etc, of a data file, so is the index (or indexes) for the retrieval of information from that data file. The index specifies which records of the data file are to be used for retrieval of results. As we have seen, indexes are automatically updated by two of the database functions. However, they have to be specified and created in the first place. This is one of the tasks of the Index subsystem, the other being to join two indexes over a given field. The result of this sort of 'join' is, normally, a table formed by concatenating elements from two indexes, such that the elements of each index have the same key-field value. The general scheme of the sub-system is shown in Fig 4.

Index creation offers a number of special facilities:

1. An index may be created, and ordered in ascending sequence, on any data field in the data file record, or on the record number.
2. Selected indexes may be created depending on whether a chosen field is equal to, not equal to, greater than or smaller than a given value or is a member of a user-specified range of values.
3. Use of the 'unique' feature excludes all data file items with the same key field, except the first.
4. A secondary sort of field may be specified for use in cases where a two-key index has to be 'joined' with two other indexes, one having one of the two key fields and one the other.
5. An index will automatically be added to the number of existing indexes, unless specified to replace an existing index.

Details of decisions made in respect of items 1 - 5 are registered in an Index Master File whose primary use is to provide information for automatic updates of indexes, as described above.

The Join function specific to DABS relates two indexes, ordered in the same sequence, such that, if the key field of an element of the 'argument' index is equal to *any* key field of an element belonging to the second or 'target' index, the record number of the data file record forming part of the element of the target index is stored in a result table under the data file number to which the target index belongs. Inequality resulting from a particular set of comparisons, that is, absence of a matching element, leaves a zero in the table. A number of such binary 'joins' can be carried out, the current limit being three. The completed table is stored in a temporary file from which

File 1 : SUP (PLIER)/MAT(ERIAL)

Record no :	1	2	3	4	5	7	7
Scode :	20	10	10	5	15	6	6
Mcode :	100	110	100	120	100	130	140
Mprice :	1.9	2.7	2.0	1.9	2.4	2.1	2.2
Mquality: :	4	5	5	4	4	5	3

File 2 : SUP(PLIER)

Record No :	1	2	3	4
Scode :	5	10	15	20
Sname :	Ferreira	Smith	Perez	Armando
Scity :	Sao Paulo	Londres	Lisboa	Sao Paulo
Scountry :	Brazil	Inglaterra	Portugal	Brazil

File 3 : MAT(ERIAL)

Record no :	1	2	3	4
Mcode :	100	120	110	130
Mname :	Armchairs	Chairs	Cupboards	Tables
Mstock :	60	36	24	48
Depot :	Hayden	Hayden	Hayden	Hayden

Fig 5

Example 1

Task: Print — Sname, Scity, Scountry from the Sup(plier) file for all records of that file having:
Scountry < Portugal (lexically) and Scity in the alphabetic range A to M (both inclusive)

Indexes

The following two indexes are established:

	INDEX 8 (Supplier)	INDEX 9 (Supplier)
Instructions	Sortfield : Scode Selec field : Scountry Selec criter : < Portugal	Sortfield : Scode Selec field : Scity Selec criter : Range A→M
Result	DATA Scode / File no / Record no 5 / 2 / 1 10 / 2 / 2 20 / 2 / 4	DATA Scode / File no / Record no 10 / 2 / 2 15 / 2 / 3

Join table

When index 8 is joined to index 9 on the sortfield, the following table results:

0.	File no.	2	0	0
1.	Record row	0	0	0
2.	Record row	2	0	0
3.	Record row	0	0	0
.....				
n.	Record row	0	0	0

Output

The output program will recognise only the first column and, within that, the row numbered 2. It will seek record 2 of file 2, having first requested identification of fields to be printed. It will then write these details from the record (either on the screen or the printer):

Sname : Smith
Scity : Londres
Scountry : Inglaterra

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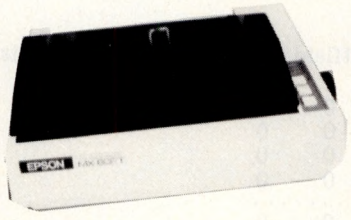

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DATA DABBLING

it is picked up by the Output function.

The Output function then examines the table horizontally over the columns in which entries were made by the Join operation, starting from the beginning of the table. For any row of data file record numbers, which does not have a zero in it, the corresponding data file and data file records are accessed and the fields previously stipulated by the user are then written to the screen or to the printer, as required.

Two examples are given of the use of the Index-create, Join and Output functions, based on the data files in Fig 5.

It will be noted that all three files are normalised and that the only connection between them is provided by the Scode and Mcode fields of File 1. Normalisation, while obviously desirable, is however, not a prerequisite of the system as such.

It will be noted that records 6 and 7 of the Supplier/Material data file are excluded. This is because the appropriate records in the other two data files are missing. Note, too, that in order to move index 13 into the table, a unique form of index 13, namely index 15, had to be joined to index 13. Joining index 13 to itself, although perfectly possible, would result in undesirable, additional combinations.

This example indicates the maximum use of the present system — matching three files to provide an answer drawn from all three.

Example 2

Task: Print — Sname from the Sup(plier) file
Mname from the Mat(erial) file
Mquality from the Sup(plier)/Mat(erial) file

for all records of the Sup(plier)/Mat(erial) file having Mprice >1.9

Indexes

The following indexes are established:

	INDEX 12 (Supplier)	INDEX 13 (Supplier/Material)
Instructions	Sortfield: Scode	Sortfield: Scode 2nd Sortfield: Mcode Selection field: Mprice Selec Criterion: >1.9

Result

DATA

Scode	File no	Record no
5	2	1
10	2	2
15	2	3
20	2	4

DATA

Scode	Mcode	File no	Record no
5	140	1	7
6	130	1	6
10	100	1	3
10	110	1	2
15	100	1	5

	INDEX 14 (Material)	INDEX 15 (Supplier/Material)
Instructions	Sortfield: Mcode	Sortfield: Scode Selec field: Mprice Selec Criterion: >1.9 Unique: Yes

Result

DATA

Mcode	File no	Record no
100	3	1
110	3	3
120	3	2
130	3	4

DATA

Scode	File no	Record no
5	1	7
6	1	6
10	1	2
15	1	5

Join table

Index 13 is joined on Index 12 on Scode
Index 13 is joined on Index 14 on Mcode } all in Scode sequence
Index 15 is joined on Index 13 on Scode

giving the following table:

0.	File no.	2	3	1
1.	Record row	1	0	7
2.	Record row	0	4	6
3.	Record row	2	1	3
4.	Record row	2	3	2
5.	Record row	3	1	5
6.	Record row	0	0	0
.....				
n.	Record row	0	0	0

Output

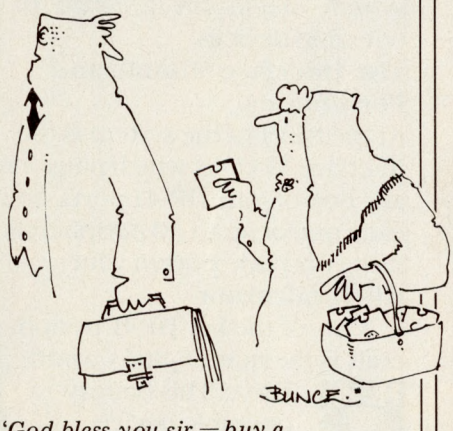
The output program recognises all three columns but, of them, only rows 3, 4 and 5, these being the only rows which are completely non-zero. It then seeks the records in each row, first requesting identification of fields to be printed. The results written are as follows:

Sname	:	Smith	Smith	Perez
Mname	:	Armchairs	Cupboards	Armchairs
Mquality	:	5	5	4

Footnote

Clearly, a multi-file system for a micro has its limitations, primarily of space. DABS, at present, handles 768 records of ten data fields each — not a great deal, but file number, record number and record status are taken care of separately. Given a third disk-drive, somewhere between 900 and 950 records could be handled, after which main memory becomes the restricting factor. A virtue of the system is, however, that it is fast. Sorting, searching and insertion of records (the latter, in some cases only) take place in main memory and access to the main data files is direct, B trees and binary array search methods being used wherever practical.

Two noteworthy points —UCSD Pascal proved entirely adequate for the task, producing code with very few errors. Pascal friends will recognise at once that this is a compliment to the language, rather than to the programmer. Secondly, while an attempt has been made to make DABS as user-friendly as practical, space considerations have made this difficult in at least one case. What can be done to overcome this, remains an interesting exercise for future leisure moments. **END**



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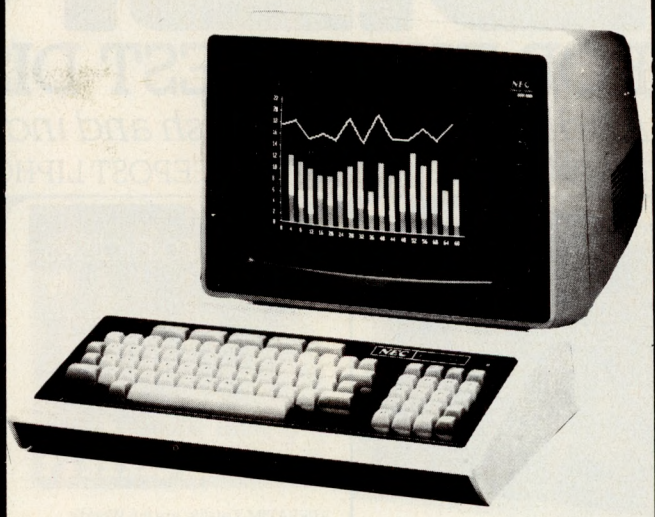

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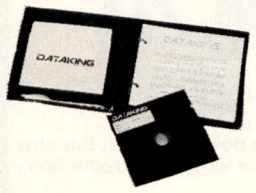

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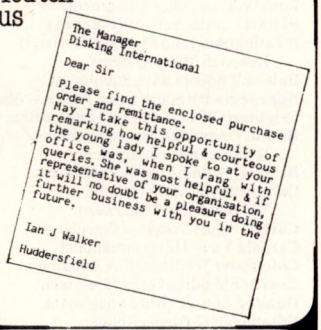

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BENCHTEST SOFTWARE

PERSONAL PEARL

Kathy Lang continues her series of database evaluations with a look at Pearl

Pearl is described by its authors as enabling the user 'to create a library of the highest quality programs designed by you, for your Personal Pearl leads you through the program design'. In use, however, it is very similar to a number of information management packages I've reviewed over recent months. Pearl begins by asking the user to define a record format, including screen layout and indexed fields, goes on to provide facilities for data entry, and then gives options to design report formats for getting information from the database. These functions are made available either through a 'service directory menu', which is shown in Figure 1, or by the user typing the program name for the particular function.

Pearl is closer to being a true database system than many I've seen, as it builds a data dictionary for indexing which is designed to permit extraction of information from one file by reference to fields in another. So, although Pearl is billed as a program generator, from a user's point of view it's much more like a data management system — you would, for instance, have a hard time trying to write production control programs with it. This is especially true as Pearl doesn't allow you to display or modify directly the programs you've 'written', only execute them and therefore it seems of little importance to the user whether particular applications are provided by parameter-driven programs or parameter-written programs. However, bearing those comments in mind, Pearl does compete quite well with some of of the other data management packages around.

Constraints

Pearl files can be as big as the CP/M limit of 8 Mb. Maximum record size is determined by layout: up to three screens' worth is permitted provided you don't exceed 250 fields. Screen displays are limited to 17 lines if you want to preserve the facility for providing HELP information on the bottom of the screen. Fields may not occupy more than one screen line, though if the screen width permits you can go up to 127 characters. Numerical accuracy is to 15 digits. Three types of field are provided: numbers, characters and dates.

One or more fields may be designated as key fields, which may be unique or may contain repeated values. Once the format of the record has been decided, changes may still be made even after the file contains data records, but only changes to and additions of non-key fields are allowed. During form design a maximum length for each field is given, but data is actually stored in packed form — so that, for instance, a field which has no value occupies no space.

Input and validation

The data input process consists of four stages. The first involves designing the layout the record is to have on the screen. This layout will be used for displaying each record when the data is input, edited or deleted. (At present only one format per data file is possible; in later releases Pearl is likely to permit several formats 'overlaying' the records in a file.) The layout process involves giving each field a label or caption and showing (for instance by using underline characters) where data will be placed for the field. The placing is at this stage purely visual, and has no implications for record formats: this comes in the next stage, which involves defining data areas.

Straightforward facilities for the novice user

Data areas are defined by placing the cursor at the start of an area; Pearl then assumes that the field extends up to the next space (on the same line — fields may not spill over two lines). For each data area you must define an abbreviated name of not more than seven letters, which is the name by which the field will be known for Pearl operations; the label is purely to help the operator, and the two could be quite different if you really wanted to do things the hard way. You then indicate the type of field, whether its presence is mandatory or not, and whether it is to be calculated from other field(s) in the same record. Index or key fields are not indicated at this stage; that is done in stage three.

To allow the user to define key fields, Pearl displays the record format just set up and asks to be told which fields are key fields, and whether each is to contain a unique key or whether more than one record may have the same value. It is not essential to define key fields; if you don't, Pearl will assume that the first field is the only key, and direct access to individual records will be possible only with that key. The fourth and final step is to establish any links there may be between this file and others set up by Pearl; it is possible to have fields copied from another file, calculated from data in another file, or just brought into the record layout for display purposes.

Once you have designed a format you can use it to enter data. The same section of Pearl is used to enter new data and to edit existing records. Data validation is quite thorough. Dates are checked for plausibility, number fields may only contain numbers, and you aren't allowed to save a record if any of the 'mandatory' fields do not have data in them. (Unfortunately Pearl only tells you about one at a time, so if you miss two you have to go round the save/re-edit cycle twice, but it's very quick.) If you enter a value in a supposedly unique key field which is already present in the file, that error too is flagged.

When retrieving existing records for editing or display, you just put the cursor on the particular key field(s) you want to match and type in the required value. Matching is by identity only while editing, although partial matches are permitted to some extent — for instance, if you are searching a key field containing names, typing 'Hill' will result in Pearl finding a record with 'Hill' in that field if there is one, if not it will find the nearest — 'Hills' for instance. You can scroll through the file by asking for the 'next record', so if there are several people called Hill you will get each one in turn, followed by Hills, etc, if they exist, and then the less closely related values such as Smith. When a record is displayed, you can get a copy of it on the printer.

Displaying data

Individual records retrieved by key can be displayed or printed as I've already described. This mechanism doesn't allow you to access records matched other than by identity, nor does it let you see them sorted or displayed using some format other than that used for input. For any of these facilities, you must use the Design Report and Produce Report functions, which are primarily provided for printed output but which can also be used to display information on the screen.

Printed reports

The second option in the Service menu allows the user to design report formats. No reports can be printed without a predefined format, apart from direct copies of the screen display. A report

PERSONAL PEARL

may display information in exactly the same way as the record is shown on the screen, or you may design appropriate separate layouts, either from scratch or by editing a layout you have used before. The process of designing report formats is very similar to that for screen formats. Reports may be of two kinds: a Fixed report format displays one record per page, while the List report format gives one line per record plus heading infomation and the ability to display sub-totals and totals. While designing a report format, you can request that the records are produced sorted in a particular order; if the report format requests sub-totals, these are produced when the value of the first sort field (which is the most significant) changes. Fixed format reports can be produced spaced out across the page to allow the printing of address labels. Any report may be sent to the screen, to the printer or to a file; this is decided not when the report format is designed but when the production of the report is requested.

Selection

When a report is produced, one of the options is to select records which lie within certain ranges. For instance, you might want to find which of your customers had been owing you money for between one and two months; you would then request a report of all records where the 'date due' was more than a month ago but less than two months ago. To match records which are equal to a particular value, you specify the same value for both maximum and minimum. Range comparisons work with all three data types, and you can specify such selections for every field in the record if you really need to. The limitations are that you can only have one selection per field — you can't for instance, select records for people who live either in Birmingham or Wolverhampton — and all the selections are combined together so that a record is displayed only if it matches all the selections, not any one of them or some other combination. Nor can you select records which contain particular values as part of a field.

Sorting

Also at the reporting stage, you can have the records sorted on a maximum of five fields, in ascending or descending order. This is requested when the report format is produced, so you can't change it when you actually come to produce (print or display) the information.You can't sort on parts of fields.

Calculations

Calculations using addition, subtraction, multiplication and division, and parentheses, can be carried out either as part of the data input process or when preparing reports. In both cases, the calculations have to be specified when the display format is set up.

Security and integrity

There aren't any mechanisms at the moment for securing the data against unauthorised access, other than the crude method of locking up the disks, or allowing people to have only the part of Pearl that permits production of reports. You can't, for instance, allow selective updating by giving someone access only to an 'overlay' which displays names and addresses but not sensitive information like salaries. As to integrity, there is a file maintenance program which will rebuild the data dictionary if there has been some problem during file updating. This program will reset the dictionary to the point before the start of editing session, so that only a few records are likely to have been lost.

As far as file and disk security are concerned, and general housekeeping such as erasing files, the user has to rely upon CP/M commands.

Tailoring

The only tailoring supplied is the ability to select a particular terminal, and to configure Pearl for different terminals if they meet some fairly specific conditions for cursor control — the system I have previously used to run Benchtests didn't conform, but fortunately we now have a Z80 card and CP/M-80 for our Sirius and I was able to run Pearl successfully on that. Would-be users would be well advised to see Pearl working on their type of terminal before buying, just in case.

Use with other programs

Pearl can write data out to ASCII sequential files, so you can use it to create files which Wordstar and other packages can read; you can also create Supercalc files. You can't read 'stranger' files into Pearl at the moment, so I couldn't run my Benchmarks, which rely on the ability to read a data file which is the same for all packages and which contains data stored in a 'predictable' way. My initial reaction is that Pearl in its 'special release' form is rather slow, particularly when loading and formatting — data access by keys was quick on a small file.

User image

The software is on the whole well designed for naive users, with menus, a pretty straightforward structure and lots of HELP on the screen. I particularly liked the display of special characters available for editing at each stage, though they did take up quite a lot of room — a perennial tradeoff. The user is also protected from him/herself in some quite nice ways, such as not being allowed to save records with duplicate keys where they should be unique. I felt that an expert user might find the menu structure tedious quite quickly. Also I must confess to a strong prejudice against gimmicks — such as the message 'My Pleasure' displayed when you leave Pearl!

The documentation is rather mixed. The tutorial sections displayed a remorseless thoroughness which I found a bit off-putting, but the tutorials did introduce enough features to let the user get off the ground without blinding him with detail. However, because the screens were displayed using ordinary type rather than being typeset, the manual was very bulky for what is basically quite a simple package which is fairly self-explanatory in use. Presumably the next release will remedy this defect, and also make some changes to the reference sections.

The reader was instructed firmly to go through the tutorial sections before reading these, and then given nearly as verbose an explanation of the material already covered all over again, as well as covering the more advanced features. The reference section of my manual covered more than than 40 pages, compared with nine in the pre-release version I had previously which seemed to have virtually all the same features. It did seem to be rather a case of 'never mind the quality feel the width'. I'd much rather have seen some effort put into a decent reference card covering all the options briefly, together with the ability to dispense with screen HELP when one became familiar with the commands and could get by with checking the occasional special key function on the reference card.

Costs

Pearl costs £150, and needs a CP/M system with at least 48k of memory. It

GOTO page 206

```
**************************************************************
(                                                            )
(                DESIGN                  OPERATE             )
(          1:    DESIGN FORMS       3: ENTER DATA            )
(          2:    DESIGN REPORTS     4: PRODUCE REPORTS       )
(------------------------------------------------------------)
(Program Name: PCWBTDT                                       )
(ENTER A SERVICE NUMBER: _                                   )
(Press RETURN  to continue, ? for HELP, or ESC to EXIT       )
**************************************************************
```

Fig 1

MS-DOS v CP/M-86

Peter Rodwell compares the two operating systems which — at the moment at least — are fighting it out for supremacy in the 16-bit market

Right now the business micro market is dominated by twin disk, 8-bit computers running CP/M as their operating system. In fact it's fair to say that CP/M, more than any other single development, has enabled business microcomputing to develop at the pace it has. By providing a standard environment which is easily adaptable to any machine with a Z80, 8080 or 8085 processor, more than 16 kbytes of RAM and at least one disk drive, it has brought order to what could otherwise quite quickly become a very chaotic situation indeed.

CP/M-80 (as we must call it, now that there's a 16-bit version), enabled programmers to produce standard software packages which could be guaranteed to run on any CP/M-80 micro. Hardware manufacturers have been able to produce machines more easily, confident in the knowledge that there was an 'industry standard' operating system which could be placed on their micro and would immediately allow buyers to choose from a wide selection of packages. The design of a Z80, twin-disk CP/M machine is now so easy that it's possible, with mass-production techniques, to churn them out in large quantities at exceptionally low prices, even with a bundle of standard software thrown in — witness the Osborne 01 at under £1300.

Originally CP/M was written for the Intel 8080 chip, as its creator, Gary Kildall, was closely associated with Intel at the time. By happy chance (well, actually, it was more than chance but I'm sure Kildall didn't predict it), Zilog produced a more powerful microprocessor chip, the Z80, which incorporated the 8080's instruction set as a subset of its own, more powerful set. Thus programs written for the 8080 could run without modification on the Z80, although Z80 programs cannot necessarily run on the 8080 unless they are confined to using only the 8080-compatible instructions and make no use of the Z80's more powerful features.

Kildall wrote CP/M-80 primarily as a software development aid; at that time personal computers were unknown and microprocessors had only just made their appearance. Designs for personal computer systems soon began to appear in American electronics magazines, however, and it was quickly realised that CP/M-80 offered tremendous advantages when used as the operating system for these machines; it meant that pioneer computerists could easily exchange software for a start and, not surprisingly, it didn't take long for people to start producing small business machines, running CP/M-80 and using the standard packages being churned out by the escalating microcomputer software business.

Interestingly, the most successful 'big three' microcomputer manufacturers — Apple, Tandy and Commodore — earned their success quite independently of CP/M-80. Apple and Commodore had no choice because their machines were based around the 6502 chip, which is totally incompatible with the 8080/Z80 family; they each developed their own (incompatible) operating systems instead. Tandy chose the Z80 for its TRS-80 range but went its own way with its own operating system, which, naturally, was incompatible with anyone else's. The 'Big Three' succeeded because they got into the market quickly with good, well-made systems which were easier to use and cheaper than most of the hobby-based systems.

Since those early micro days, the situation has of course changed. Exact figures are very hard to come by in this business but it's fair to say that the Big Three together have about a 50 percent share of the business market while CP/M-80 machines have taken the other half. The number of software packages available for CP/M-80 systems is staggeringly huge and ranges from system utilities through language compilers and interpreters to all sorts of applications packages.

When 16-bit microprocessors appeared, everyone realised that the industry was heading for a rather awkward situation. A vast user base had been established and a massive range of (mostly) well tried and tested standard software was available. But none of the three important 16-bit chips — the Intel 8086, the Motorola 68000 and the Zilog Z8000 — could run any of this software; not even Zilog had had the consideration to make its new heavyweight code-compatible with its old success, the Z80. So all that standard software, into which a lot of money had been poured and with which hundreds of thousands of users were familiar, wouldn't run on the new machine, and neither would CP/M-80 itself.

Clearly the industry had to come up with a new standard operating system so that software producers could get down to converting their packages and users could get their hands on the new generation of machines. But as the three 16-bit chips all had totally different, incompatible instruction sets, no operating system could be adopted as a standard until it was known which chip was going to lead the field.

At this stage in the game, Digital Research (the company founded by Kildall once he realised he was onto a good thing with CP/M-80) was in a very powerful position. There are operating systems which can be run on any machine and for which programs can be written that are totally transportable. One such is the UCSD p-System (read about it in the last three issues of *PCW*), in which only a small central core needs to be written in the 'native code' of the processor involved; all programs are written in a high-level language, typically Pascal, and compiled into an intermediate code, p-code, which is translated into native code as the program is run by the central core. But a whole generation of microcomputer programmers have been weaned on CP/M-80 and are familiar with its innards. To convert CP/M-80 packages to a totally alien environment would have been expensive and time-consuming. These people looked to Digital Research to provide as familiar 16-bit environment as possible so that conversion involved a straight translation of assembler souce code plus a few other tweaks, rather than the entire restructuring that an alien environment might require.

The difficulty was to know which processor would be the favourite with hardware manufacturers. The Zilog Z8000 was an early front-runner but hardware makers were put off when AMD decided not to second-source the chip (a decision it recently reversed); no manufacturer wants to base a product around a chip coming from a single source because he'll be high and dry if that source disappears — and despite the success of the Z80, Zilog has never managed to run at a profit.

That left the 8086 and the 68000. Chip buffs are unanimous that the 68k is the more powerful of the two but legend has it that when Digital Research went knocking on Motorola's door, asking for 68000 details because they wanted to write the new CP/M for it, they found that nobody at Motorola had even heard of CP/M-80 and they were gently but firmly shown the exit. Whether this is true or not I don't know and neither have I ever been able to find out exactly why Digital opted for the 8086. But go for the '86 they did, and produced CP/M-86, even though nobody seemed too interested in using it in a real system.

One factor which may have tipped the scales was a new microcomputer from a company which, while unknown in the micro world, had been doing quite nicely in the world of big computers. The long-awaited, long-heralded, much-speculated-about IBM Personal Computer turned out to be based on the Intel 8088, a 'sawn-off' version of the 8086. (Internally it's a 16-bit processor but it addresses memory as 8-bit bytes rather than as 16-bit words, which is what the '86 does; it is, however, code-compatible with the 8086.)

Meanwhile, with the sort of arrogance a big company accumulates when it's three-quarters of the way to dominating the world, IBM felt that a CP/M operating system wasn't quite good enough and chose a Microsoft product instead, calling it PC-DOS. But Digital Research produced CP/M-86 for the IBM machine anyway and other

MS-DOS v CP/M-86

manufacturers, figuring that IBM would be a safe bet to imitate, began work on 8088 and 8086-based computers. Microsoft, too, realised that if PC-DOS was good enough for IBM it should be good enough for the rest of the microworld and released its 16-bit operating system to us all, under the name MS-DOS.

Thus, as more and more 16-bit systems appear, we can detect a distinct leaning towards the 8086/8088 family and towards CP/M-86 and/or MS-DOS. The ACT Sirius 1 is already here, British Micro is about to launch an 8088-based machine and on their way are at least half a dozen Japanese 'IBM lookalikes', lead by Hitachi and using one or both of these operating systems.

Before I look into MS-DOS and CP/M-86 in detail, though, I think a few words on the subject of operating systems as a whole are in order.

The perfect operating system

There is, of course, no such thing as the perfect operating system. For reasons which totally escape me, operating systems, like programming languages, religion and politics, seem to inspire quite ridiculous degrees of fanaticism, frequently bordering on bigoted blindness, if some of the hate-mail we receive here is anything to go by. (I cannot understand why anyone should get so upset about a subject like operating systems, which, in the global scale of things, are pretty insignificant — but people do.)

Before microcomputers appeared, computers were large, isolated machines tended by highly-trained people — programmers, operators and so on — who, because they were highly trained, were able to make sense of the arcane jargon and terminology which surrounded the machines. It mattered little that the man in the street was totally mystified by the whole business because no ordinary men in the street ever came anywhere near a computer.

Microcomputers have changed all that. Not only are they appearing on desktops in every conceivable kind of business, but they are flooding homes as well, now that anyone with £50 to spare can buy a computer. Most of the people who are now using personal computers in their work places have no computing knowledge or experience and neither do they want to become computerists: the modern business personal computer is a tool, purchased to improve business efficiency and make life easier. Within three years' time, businessmen will walk into their local business equipment shop to buy a computer in much the same way as they now buy a typewriter or photocopier; they will have a business problem of some sort and will be looking for a piece of office equipment which will help solve that problem.

The average businessman simply does not want to have to learn about *computers*; he wants to know which software will do the job he wants done, which piece of hardware will run that software properly and that's all, basically. All he wants to do then is to buy the system, plug it in and get down to work with it. Anything which prevents his doing exactly that is an obstruction, an inconvience and a disincentive for him to get involved with computers at all. After all, if you buy a photocopier, you don't want to have to learn about photocopier technology before you can use the thing.

When he sits down to operate his computer, the businessman has three 'levels' at which he could come across problems. Firstly there's the hardware. These days, it's possible to make this pretty foolproof, with the only specialised knowledge being confined to knowing how to turn the machine on, how to put in a disk and how to look after floppy disks correctly. Then there's the applications package he wants to run. Early business packages for micros were pitifully awful, requiring careful use to avoid crashing, demanding rigid syntax and being accompanied by unreadable documentation. Slowly this situation has changed, as software writers realise that their products are being used by computer-naive people who will never understand phrases like 'default back-up store' or who will always accidentally type a letter of the alphabet when they should be typing a number. Gradually we are seeing packages which isolate the user from the bits-and-bytes end of computing and actually cope with mistakes in a helpful and useful way. Documentation, too, is improving, although horrors still abound — take a look at a Wordstar or a Newbrain manual and you'll see what I mean.

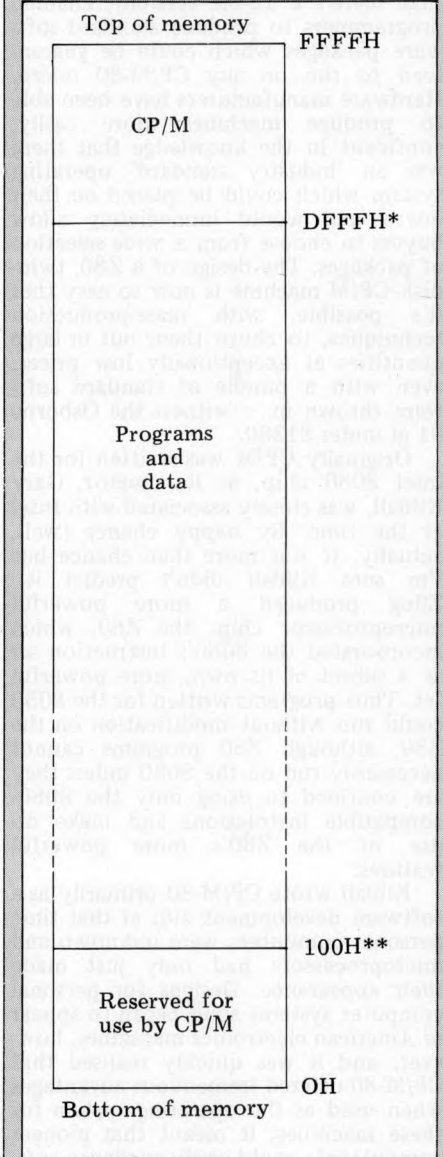
But although considerable steps are being taken to make both applications packages and their documentation user friendly, it's important to realise that operating systems, too, need to be just as friendly and easy to use. When he sits down in front of his computer, the businessman needs the maximum amount of help to achieve his goal; he should not have to wade through pages of instruction manuals in order to understand how to work the machine and he should not be required to learn any special vocabulary before he can make the machine do something sensible. The operating system should enable him to get his application program running as quickly as possible and allow him to carry out whatever 'housekeeping' jobs he has to perform (formatting new disks, taking back-up copies of files, etc) with ease.

Operating systems in the micro world have thus to fulfill two distinct — but by no means mutually exclusive — roles. They must firstly enable software houses and programmers to produce good applications software as quickly — and therefore as cheaply — as possible by providing a useful set of 'interfaces' between the program and the hardware. And — maybe more importantly — they should enable the fast-growing pool of naive users to use their micros as efficiently as possible, with minimal training and/or specialised knowledge.

There are two other, less immediately obvious, qualities that our

What is CP/M?

In a microcomputer, the operating system is the link between the computer's hardware and the program actually in use. An operating system such as CP/M consists in essence of a series of routines which perform all the boring, mundane but essential tasks involved in computing. This includes things like accepting a character typed at the keyboard, displaying it on the screen, sending characters to the printer and handling the detailed work involved in dealing with disk files. Figure 1 shows how this works on a micro: at the centre is the hardware; between this and whatever programs are being used is the operating system, the program called CP/M (which stands, in case you wondered, for Control Program/Microprocessor). The operating system thus acts as a 'buffer' between the hardware and other software, which could be either applications programs written in assembler language, as



a) A 64k system

*Approx address - depends on size of B10S

**Area below 100H not shown to scale!

Fig 2 Memory maps for CP/M systems

shown in the left half of the circle, or a language interpreter which is interpreting an applications program written in a high-level language such as Basic.

Programming under CP/M

As most programs need at least the ability to accept keyboard input and to display something on the screen, it makes life a lot easier for the programmer if the routines to do this are already available and don't have to be re-written every time a new program is being developed. In addition, the way the computer's hardware is arranged differs from machine to machine, so that while one computer may have Port 0 as its keyboard port, another might use Port 50 for this purpose. A special section of CP/M, called the BIOS (Basic Input/Output Section) contains all the routines which are 'machine specific' (ie, which involve special hardware features which differ between micros) so that, to install CP/M on his product, a manufacturer has only to re-write portions of the BIOS as appropriate.

With the BIOS suitably customised and CP/M successfully installed, any program written for CP/M will then be able to run on it without modification because to perform any of the basic system functions (getting or displaying a character, for instance), the program has merely to execute a subroutine call to an address in a reserved part of memory which is *always* the same, no matter which machine is being used.

As an example of how this works, let's suppose we want to send the character 'A' to the screen. Figure 2a shows the memory map of a typical CP/M computer, from which you will see that the first 256 bytes of RAM, from locations 0H to 0FFH are reserved for CP/M and that CP/M itself occupies the topmost portion of RAM, typically about 8k or so. In between, starting at location 100H, is the area where programs and data are kept; all CP/M programs must therefore be written to start at 100H. Exactly what CP/M does with all of those 256 bytes needn't concern us here; we're interested in just one location, at 5H. To put the character 'A' on the screen, we must first load it into the processor's E register (remember we're dealing only with the 8080 and Z80 chips), and the *system call* number in the C register. The system call number is simply the number of the operating system routine we wish to execute, obtained from the CP/M documentation which lists all the calls — in this case we want system call 2, so we place the value 2 in C. We now execute a subroutine CALL to location 5. Locations 5, 6 and 7 contain a JUMP instruction to the address inside CP/M up at the top of memory where the routine to work out which function we want and then to execute it lies. The function is executed and CP/M then carries out a RETurn from subroutine instruction to return us to our program.

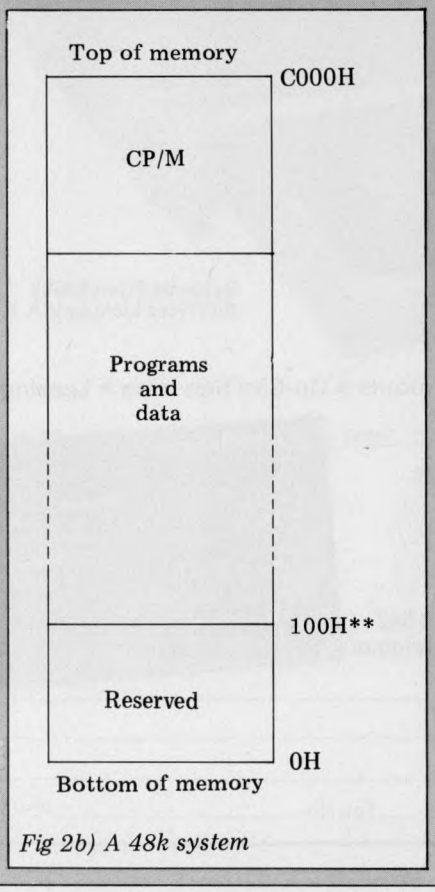


Fig 2b) A 48k system

This may at first sight look a little tedious but in fact it's done for a very good reason. With CP/M you get a utility program to generate a version for any memory size (above 16k); if you want to generate a version of CP/M for a 48k system instead of the standard 64k, you run this program, feed in the relevant details and it produces a new version, which would look something like the memory map in Figure 2b. Notice, though, that this new version still requires those 256 bytes at the bottom; if you were to compare the contents of locations 5, 6 and 7 in the two versions, you'd find they JUMPed to different addresses — the configuration program had so arranged things that, while the addresses of the actual systems calls themselves had changed, a program using them would still work — all that would happen is that when the CALL to location 5 was made, a different address would be JUMPed to automatically, without any modifications being required to the actual program.

CP/M thus frees the programmer of two major headaches: hardware features and memory size. Provided a system has enough memory to contain the program plus whatever extra space the program needs for data storage, it will run on any CP/M machine regardless of the machine's hardware configuration and memory size.

The example I have given is based on the way CP/M-80 works; CP/M-86 and MS-DOS are slightly more complicated but are based on the same principles.

In use

When the user switches on his machine and inserts the system disk, CP/M is loaded into memory and control is passed to a section of it which displays the 'A>' prompt and waits for something to be typed in at the keyboard.

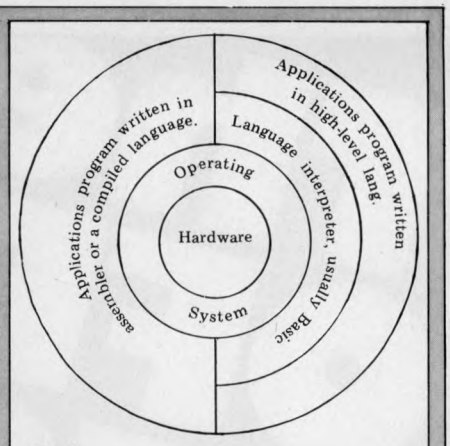


Fig 1

As each letter is typed in, CP/M places it in a reserved area of memory (within that 256-byte lower section) and waits for the next character. It keeps doing this until a carriage return is typed, to signify the end of the command. CP/M then checks first to see whether what has been typed is the name of one of its built-in or *intrinsic* commands, such as DIR, the command to display a disk directory; if it is an intrinsic command, CP/M executes it and goes back to displaying the 'A>' prompt and waiting for the next command.

If the command isn't an intrinisc command, CP/M then searches the disk directory for a program with the same name. If found, the program is loaded into memory from location 100H onwards and control is passed to that program. If there isn't a program with that name on disk, CP/M indicates this fact by the rather crude expedient of re-displaying what you typed followed by a '?' and going back to waiting for another command.

CP/M-80, CP/M-86 and MS-DOS are all single user, single task operating systems. This means that only one person at a time can use the machine to perform only one task at a time. There are operating systems for micros which will allow single user multi-tasking operation, in which one user can have several jobs running at the same time; such a version of CP/M-86, called Concurrent CP/M-86, is promised for the future and it seems logical to assume that a similar version of MS-DOS could also be on its way.

Attempts have been made to produce multi-user operating systems for micros. Trying to do this with an 8-bit system has proved fairly unsuccessful as the poor little processor gets swamped pretty quickly. Even on a 16- or 32-bit micro, the exercise is, frankly, pointless; each user must be provided with a screen and keyboard, both of which are relatively expensive. The processor is made to serve several users by means of a complex (and therefore expensive) operating system yet the processor is the cheapest part of all! It makes far better economic sense to give each user a processor of his/her own — ie, to give them each a microcomputer — and network the micros together to share just the expensive parts such as hard disk drives and daisywheel printers.

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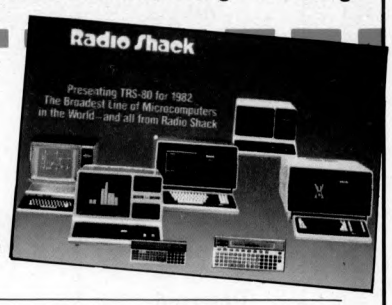

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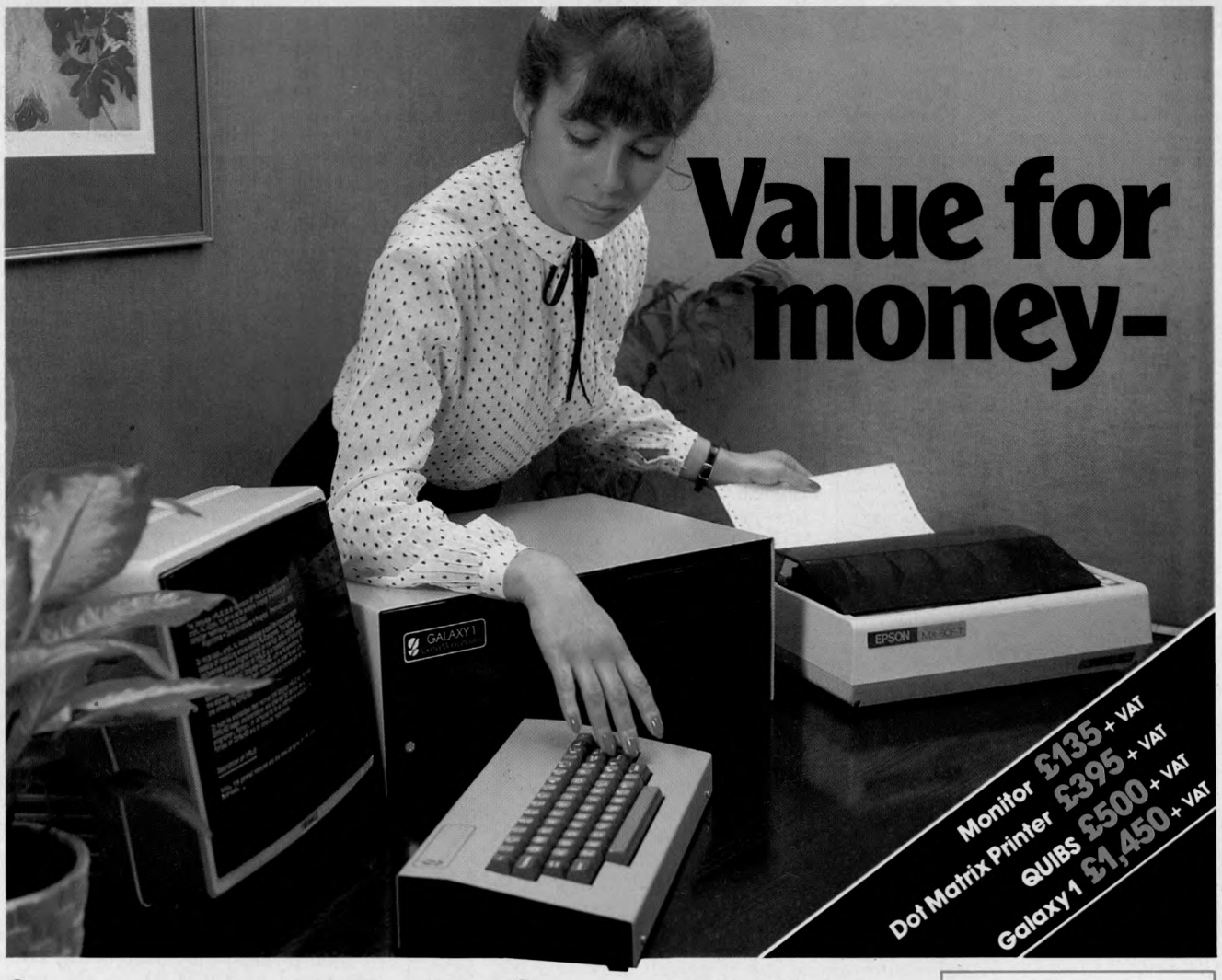

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MS-DOS v CP/M-86

'perfect' operating system should have: robustness and consistency. Robustness means that if the user does something wrong — say he tries to write to a write-protected disk — the operating system should recognise the error, give the user a useful error message ('That disk is write-protected, nerd!') and allow him to correct the error quickly and easily. He should be able to recover from the error situation and continue with his applications program unhindered. Consistency means that the command syntax should always follow the same style, so that if he needs to use one of the system's more obscure commands — maybe one he's never used before, or has used very infrequently — he should be able to guess the correct syntax simply by using the same format as is required by all the other commands; there should be no unpleasant, difficult-to-remember exceptions to the command syntax and, as far as our upcoming band of naive users is concerned, the command language should be in something closely resembling English as she is spoke, rather than in terse, arcane abbreviations.

Such a 'perfect' system would have to be a fairly large piece of software, and there was never really any question of developing such a thing for 8-bit micros because they are limited to 64k of memory; there's not enough space to hold a big operating system and leave a sensible amount of room for a business package and its data. But 16-bit micros, with their much larger addressing capacity, do give us the room we need, especially as the price of memory is falling continually. Their increased processing power means that, although there would be a far greater amount of thrashing about to be done, the net result should still provide the end user with faster response times and a quicker-running programs than he currently gets with an 8-bit machine.

I have gone on at some length about the requirements of the naive computer user because, after all, it is he for whom the microcomputer is designed (a fact which seems to escape some hardware and software producers, even now). As I said earlier, nearly all business micros are — and will be in even greater numbers — sold to such users and it's up to the industry as a whole to give them what they need and want, not what some cloistered academic feels they ought to get or what some manufacturer decides is the cheapest and easiest thing to give them.

In the following comparison between MS-DOS and CP/M-86 , then, I have very firmly taken the user's side. Although a good operating system should make life easier for the programmer too, to lower software development costs and development times, in the end it's the attractiveness or otherwise of the system to the user that's the most important consideration.

```
COMMAND  COM    5151   5-25-82   9:11p
FORMAT   COM   16894   5-26-82   3:40p
DCOPY    COM   15719   5-26-82   3:32p
RDCPM    COM   11143   5-25-82  11:59a
MBASIC   COM   30720   5-20-82   2:13p
CHKDSK   COM    1976   5-26-82   2:54a
SETIO    COM     935   5-20-82  12:46a
EDLIN    COM    2304   8-04-81
ARCHIVE          0   1-01-80  12:09a
TO             30720   5-20-82   2:13p
BASCOM   COM   39552   5-20-82   7:44p
BASCOM   LIB   75264   5-20-82   7:48p
BASRUN   EXE   20608   5-20-82   7:50p
BASRUN   LIB    3072   5-20-82   7:52p
DEMO     BAS     512   5-07-82  12:00a
LINK     EXE   41216   2-04-82   1:47p
MP       COM    7781   5-20-82   7:13p
MP       LOD   19840   5-20-82   7:07p
MP       HLP   36224   5-16-82   5:14p
MP       SYS   22656   5-20-82   7:10p
MP       DAT    6272   5-20-82   7:15p
```

Fig 2

```
A: PBASIC86 CMD : MAILMRGE OVR : WS       CMD : SUBMIT   CMD
A: FORMAT   CMD : WSMSGS   OVR : FIXLABEL CMD : DDT86    CMD
A: WS       KEY : FRED     KB  : TIME     CMD : WSOVLY1  OVR
A: code     BAS : EDIT     SUB : PRINT    SUB : SET      CMD
A: DIAB66   CMD : CARDBOX  COM : EDIT     BAK : FRED     KEY
A: DCOPY    CMD : STAT     CMD : BOOTCOPY CMD : ERIC     KEY
A: ERIC     KB  : PIP      CMD : ASM86    CMD : GENCMD   CMD
A: ALLOC    CMD : 132C     CMD : UDCCALC  CMD : BASIC    CMD
A: SETKEY   CDE : TEMP     BAS : KEY      BAS : KEYGEN   BAS
A: CEDIT    BAS : SETKEY   BAS : NEWSYS   COM : 86       COM
A: STAT     COM : PIP      COM : ASM      COM : DDT      COM
```

Fig 1

dir	Display directory of disk in default drive
dir d:	Display directory of disk in named drive
dir filename.ext	Search for named file on disk in default drive
dir d: filename.ext	Search for named file on disk in named drive
dir *.ext	Search for files with named extension on default drive
dir filename.*	Search for all named files with any extension on default drive
dir x????????.*	Search for all filenames beginning with x with any extension on default drive
era filename.ext	Erase named file on default drive
era d: filename. ext	Erase named file on named drive
era *.*	Erase all files on default drive
era *.ext	Erase all files with named extension on default drive
era filename.*	Erase all named files with any extension on default drive
ren newname.ext=oldname.ext	Rename file on default drive
ren d: newname.ext=oldname.ext	Rename file on named drive
type filename.ext	Display the named file on default drive
type d:filename.ext	Display named file on named drive

Fig 3 CP/M-86 intrinsic commands

bootcopy	Copies the operating system from the system sectors of one disk to those of another
dcopy	Copies entire contents of disk in one drive to disk in another, simultaneously formatting the second disk if necessary
format	Formats disk
pip	Similar to CP/M-80's PIP but more powerful than MS-DOS's intrinsic copy command as it can copy files to the console or other peripheral device as well as having concatenation capabilities
stat	Also similar to corresponding CP/M-80 command — displays information about files on a disk and space remaining but also allows different devices to be configured to the computer, eg, a serial printer instead of a parallel one
submit	Batch processor which takes a list of commands in a pre-prepared file and executes them sequentially

Fig 4 CP/M-86 utilities

On the surface

Both operating systems make no secret of their lineage: they both betray strong influences of CP/M-80 to the extent that it's frequently impossible to tell that you're using a 16-bit system. Many of the commands used by both systems are identical to those of CP/M-80, which is a mixed blessing indeed: anyone moving from CP/M-80 to either 16-bit system would find the transition easy but all the boring, awkward things are there too.

When first booted up, CP/M-86 behaves exactly like CP/M-80 and gives you the famous 'A>' prompt. MS-DOS asks for the date and time, for reasons I'll come to in a moment, and then gives the same prompt. This 'A>' prompt can be very confusing, escpecially in the invironment in which I have been running both systems, a Sirius 1 equipped with a Z80 card to allow it to run CP/M-80 as well — three operating systems on one machine, all with the same prompt!

Typing DIR for a directory gives the first major difference. CP/M-86 displays exactly the same directory listing as CP/M-80, a list of file names across the screen and that's all — see Figure 1. MS-DOS is much more helpful, presenting a list of names, the exact size in bytes and the date and time each file was created or last altered, plus the total number of files on the disk — see Figure 2. This finer 'granularity' of MS-DOS is said to indicate that it uses the disk space more efficiently than CP/M-86, in which the minimum recognised file length is a rather hefty 2 kbytes. All this information is extremely useful and I can see no excuse for

Digital Research's failure to provide a similar facility in CP/M-86; it would be even nicer if MS-DOS also indicated how much disk space was occupied and how much was left free. Typing 'DIR/P' with MS-DOS gives a paged version of the directory — the listing stops when a screenful has been presented and prompts you to press any key to list the next screenful when you're ready.

Both systems have wildcard capabilities in the DIR command: typing 'DIR *.BAS' will display only those files with the '.BAS' extension in both systems. And both allow the use of '?' to match any character in a filename, so that DIR BANK???.* will display all files beginning with BANK and having three other letters in their names, such as BANKERS, BANKING, etc.

Programs which are executable directly from the operating system (ie, those which have been written in assembler language or compiled) are fired up merely by typing their name. Under CP/M-86 these programs have the extension '.CMD' while MS-DOS sticks to the original CP/M convention of '.COM'.

An interesting and demi-useful feature of MS-DOS is its 'template'. When a command (such as a program name) is typed in at the keyboard and the return key is pressed, the command is copied into an area of memory called the template. A series of editing commands is available, actioned by pressing the escape key followed by a letter, which allows you to insert or delete characters within the template and to copy the template back into the command line. This means that a complicated command such as COPY A:PROGNAME.BAS B: PROGNAME.BAS can be altered to COPY A: PROGNAME.COM B: PROGNAME.COM without the whole line having to be re-typed, although, personally, I found the sequence of commands to do this just a little tedious. The sequence ESC U copies the entire template into the command line, allowing you to repeat a command with just two keystrokes. A rather pointless limitation with the template facility is that the letter following the ESC must be typed in upper case; this is particularly silly as MS-DOS accepts commands in either upper or lower case and is annoying on the Sirius as its keyboard is always in lower case when the system is first fired up.

Both systems allow you to 'edit' the command line itself, although, frankly, neither are particularly easy to use and I generally find myself using only the CTRL-X feature, found on both, which simply deletes the entire line and allows you to try again. Typing a non-existent program name produces a 'Bad command or file name' error message from MS-DOS, while CP/M-86 merely repeats what you typed (translated into upper case if you had typed in lower) followed by a '?' and the prompt.

A major source of irritation (to me, at least) with CP/M-80 is the requirement to type CTRL-C whenever a new disk is inserted. This is done because the operating system maintains a 'map' of the disk in memory and, if a new disk is inserted without CTRL-C being typed to tell it what's happened, the system gets horribly confused when it tries to access the new disk and finds its contents don't match the 'map'. Very regrettably, CP/M-86 also demands new disks to be logged in with CTRL-C. MS-DOS, on the other hand, is rather more clever: it detects the opening of a disk drive door and automatically logs on the new disk, so there's no need for the user to bother about telling the system what he's done.

It's of paramount importance to make back-up copies of everything you keep on a disk and an operating system should provide a quick and easy way to do this. These two go about it in different ways. CP/M-86 adheres to CP/M-80 practice by providing a utility program called PIP (Peripheral Interchange Program). Calling this program with a command such as PIP A:filename=B:filename will copy a file from the disk in drive B to the one in drive B. Wildcard characters can be introduced, as described in the DIR command above, so that PIP B:=A:*.BAS will copy all files with the '.BAS' extension from drive A to drive B. Files can also be renamed as they are transferred: PIP B:newname=A:oldname.

PIP is in fact much more than just a file-copying utility, for files can be transferred to other devices, such as the screen or printer, by inserting the appropriate device names instead of destination files, such as PIP LST:=B:filename, which would send the file to the printer. Additionally, there's a whole host of parameters which can be tagged onto the end of the command line to do things such as verifying after transfer (for disk transfers only), converting ASCII files from lower to upper case, stripping out form feeds and inserting them after a specified number of lines have been sent.

MS-DOS has no direct equivalent of PIP and approaches the back-up facility in a different way. A command called COPY is built into MS-DOS (rather than being a separate program, as is PIP) but is far less versatile than PIP, although its syntax is rather friendlier. COPY A:filename B:filename transfers the file from the A drive to the B drive — note that the syntax is exactly the opposite to that of PIP! Files can be renamed and concatenated and Cromemco's similar XFER function, for a renamed and concatenated as they are transferred. Having used PIP on CP/M-80 machines, and Cromemco's similar XFER function, for a long time, I found COPY a little awkward to get used to, mainly because of the source-destination reversal in its syntax; other users with no previous CP/M convictions have found it far

Copy fs	Copy file onto default drive
copy fs1 fs2	Copy first file onto second file
copy fs1+fs2 fs3	Copy first and second files onto third file
copy/b fs1+fs2	Copy first and second binary files onto first file
copy fs1/b+fs2/a fs3/b	Copy first binary and second ASCII files onto third binary
copy fs1/a fs2	Copy first file up to first embedded CTRL-Z onto second file
copy *.ext fs	Copy first file group onto second file
copy *.ext1 *.ext2	Copy files with extensions matching first onto second file group
date	Display date
date mm-dd-yy	Set new date
del fs	Delete named file
del *.ext	Delete all files with matching extensions
del d:filename.*	Delete all files on named drive with matching name regardless of extension
dir	Display directory of disk in default drive
dir d:	Display directory of disk in named drive
dir fs	Display directory entry for named file
dir x???????.*	Display directory entries for all files starting with x regardless of extension
pause	Suspend execution of batch file
pause (comment)	Suspend batch file execution and display comment
rem (comment)	Display comment during batch file execution
ren oldname.ext newname.ext	Rename file on default drive
ren d:oldname.ext newname.ext	Rename file on named drive
ren d:*.ext1 *.ext 2	Change extensions of all the files with ext1 on named drive to ext2
time	Display time
time hh:mm	Set time — hour and minute
time hh:mm:ss	Set time — hour, minute and second
type fs	Display named file

Note: fs = file specifier, made up of optional drive name, a file name of up to eight characters and an optional extension

Fig 5 MS-DOS intrinsic commands

chkdsk	Gives details of disk and system memory status — how much used, how much remaining
dcopy	Copies entire disk onto another, formatting second disk if necessary
format	Formats a disk, with option soft error reporting and optional automatic creation of system on second disk
rdcpm	Transfer a CP/M file from a CP/M disk onto an MS-DOS disk. Of course this is for data files only — it doesn't automatically translate a CP/M-86 program into an MS-DOS program!

Fig 6 MS-DOS utilities

easier to use than PIP and certainly the word 'copy' makes a lot more sense to the naive user than 'PIP'.

Syntax reversal also takes place with the command to rename (without transferring) files: REN B:oldname newname for MS-DOS, REN B:newname=oldname for CP/M-86 to change the name of a file on drive B. File deletion is carried out with DEL filename for MS-DOS and ERA filename with CP/M-86; both renaming and deletion can be used with wildcards on both systems. Wildcards can be rather dangerous when deleting files so both operating systems trap any attempt to delete everything on a file using DEL *.* or ERA *.*. CP/M-86 rather tersely asks 'ALL (Y/N?)' while MS-DOS produces a genteel 'Are you sure (Y/N)?' In both cases, typing 'n' aborts the command, leaving your files intact.

While on the subject of messages, I should mention what happens when you try to write to a write-protected disk. True to its ancestry, CP/M-86 gives an expanded — but just as useless — version of the now-infamous 'BDOS err on B: Bad sector' message. MS-DOS is slightly better, with 'Disk error writing drive B Abort, retry ignore'. Neither matches my Cromemco's 'Diskette in drive B is write-protected' message under the same circumstances.

Both operating systems have a TYPE filename command which simple throws the contents of an ASCII file onto the screen and, optionally, to the printer too.

MS-DOS has two additional built-in commands for which there are no CP/M-86 equivalents, TIME and DATE. These display the time and date respectively and offer you the chance to update them if required. You can set both as part of the command line by typing, for example, DATE MM-DD-YY; note the American date format which, irritatingly, is compulsory.

Other utilities

Both operating systems come with very comprehensive utilities to configure the operating system to your particular needs, such as catering for parallel or serial printers and — for the Sirius — defining character sets and keyboard layouts. Additionally, both systems have a number of other utility programs for performing various 'housekeeping' functions.

Both have a FORMAT program to format new disks and in both cases this can optionally display a report of any faults encountered during the formatting process. The MS-DOS FORMAT program will also, if the option is selected, place a copy of the operating system on the newly-formatted disk. CP/M-86 has a separate program called BOOTCOPY to do this.

Both also have a program called DCOPY which will copy the entire contents of a disk from one drive to another, including the systems tracks, and both will format the destination disk automatically if necessary. This provides a very hand and quick method of taking a backup copy and in both cases you have the choice of typing DCOPY A: to B: to do it automatically or just DCOPY, which will load the program and prompt you for source and destination drives, giving you the chance to insert a fresh source disk to be copied if required.

The powerful STAT program has been transferred from CP/M-80 to CP/M-86. This allows you to check the amount of space left on a disk, to list the files on a disk alphabetically with a report on their lengths and to change certain features of the operating system; the latter facility allows you to, for example, change the default system printer from a parallel to a serial unit with STAT LST:=LPT:. STAT is a little like PIP in terms of its power and extent and once again there isn't a direct equivalent in MS-DOS. There is a CHKDSK command to give a summary of a disk's space alloction and, of course, file sizes are shown in the DIRectory listing.

Both systems allow you to set up batches of jobs to be done. A text file is written with a word processor or line editor, containing a list of programs to be executed in the order in which they are to be run. To be recognised as a batch file, this must have the extension '.BAT' for MS-DOS and '.SUB' for CP/M-86.

CP/M-86 requires a special program called SUBMIT to run a batch file; you simply type 'SUBMIT filename' and the commands are executed in sequence. However, the disk containing SUBMIT must not be write-protected as SUBMIT creates a temporary file on disk while it's working. Batch processing is much simpler under MS-DOS: the batch processing software is built into the operating system and one merely types the name of the batch file for it to be executed. If the disk contains a file called AUTOEXEC.BAT, this will be executed automatically on boot-up, over-riding the automatic requests for time and date.

Performance

As both operating systems are single-user, single-tasking systems, there isn't a great deal to say about their performance, except in the area of disk handling. Here, MS-DOS seems to be noticeably quicker than CP/M-86 although lack of time has prevented my running a series of benchmark programs to show just how much faster it is. I did, however, time the loading of Microsoft's Basic 5 interpreter under both systems, in each case from a disk which was otherwise empty. Under CP/M-86 this took an average 4.8 seconds while MS-DOS took 2.1 seconds. Using a variety of other packages, such as Wordstar under CP/M-86 and Multiplan under MS-DOS, I certainly seemed to spend less time waiting around for disk access with MS-DOS than with '86, although until Wordstar becomes available under MS-DOS, I won't be able to quantify this different, either.

Documentation

As I was using both systems on a Sirius, I had the Sirius manuals to both systems. These were user's guides and explained all the facilities of each system thoroughly, with examples, and with excellent use of typography to clarify things.

I have seen very early versions of the CP/M-86 programming guide and these seemed slightly better than Digital Research's previous attempts at documentation. Despite a couple of letters and phone calls to Microsoft, I have not yet managed to get my hands on any 'official' MS-DOS documentation and therefore cannot comment on it.

Programmers will certainly need further information on both systems before they can get to grips with them. I understand the documentation is now ready in its final form for CP/M-86 and full programming aids including an assembler and debugger — in fact precisely the same tools as are provided with CP/M—80 — are now available for CP/M-86. Curiously, Microsoft seems to have taken its time to produce an MS-DOS assembler but I'm told this has now been done and will be available very shortly. Several companies are already offering high-level language compilers for both systems — Microsoft has produced a Basic compiler for MS-DOS and there are Pascal, Cobol and C compilers out now for both systems.

Conclusions

My main aim in investigating these two operating systems has been to see how closely or otherwise they approach the 'perfect' operating system outlined earlier. I must state now that neither come anywhere near this standard but that's not too surprising, given their ancestry and the current newness of 16-bit microcomputers. It will take a while for somebody to develop the 'perfect. system and even longer for it to become recognised as such and adopted as a standard, by which time of course we'll be ankle-deep in 32-bit machines and gigabytes of RAM!

For users graduating from CP/M-80 micros, CP/M-86 will of course be the more familiar of the two. This means that the simplicity of CP/M-80 has been retained but so also have its bad points, especially its very unhelpful user interface. A 'Help' facility is supposed to be on its way to supplement CP/M-86 in some way, but I'm not sure at the moment whether this will be integrated into a new version of the system or supplied as a separated, but linked, text file; I suspect the latter.

MS-DOS is certainly friendlier than CP/M-86 and definitely gives faster disk handling. It incorporates sensible error messages (well, much more sensible than CP/M-86) and generally feels a lot more robust and easier to use.

Of the two, then, I found MS-DOS the nicer to use. At present there seems to be less in the way of applications software available to run under it than is currently up and running under CP/M-86 — but I expect this situation to change pretty quickly as more and more software for the IBM Personal Computer becomes available on this side of the Atlantic and, of course, as more machines running MS-DOS appear.

END

PCW SUBSET

Alan Tootill presents more useful assembler-language subroutines. This is your chance to help build a library of general-purpose routines, documented to the standards we have developed together in this series. You can contribute a Datasheet, improve or develop one already printed or translate the implementation of a good idea from one processor to another. PCW *will pay for those contributions that achieve Datasheet status. Contributions (for any of the popular processors) should be sent to : Sub Set,* PCW, *62 Oxford Street, London W1A 2HG.*

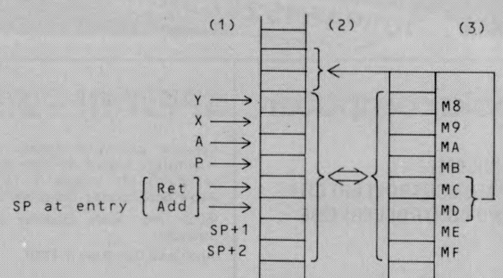
Make something of this

Study the 6502 routines BOX and COX in our first Datasheet from Dave Barrow of Hemsworth. At one fell swoop BOX provides access to all the register and flag values and clears the X register and the carry, while page zero memory M8 to MF is saved on the stack. If called at the start of a subroutine, the return address from that calling subroutine is usefully in page zero memory at ME-MF.

The idea is for you to devise imaginative and practical uses for the routines and we will print the best ones sent in.

Datasheet

```
;=BOX & COX - block exchange of page zero & stacked
;=            registers
;=          - close (inverse) procedure
;/CLASS. 1
;/TIME CRITICAL? No
;/DESCRIPTION: Exchanges 8 bytes of page zero memory with
;/             top 8 bytes of stack after pushing P, A, X, Y
;/             - inverse procedure
;/ACTION:
;/
;/
;/
```




```
;/
;/            BOX
;/                 1 Push registers
;/                 2 Exchange stack, M8 - MF
;/                 3 Push MD, MC, RTS
;/            COX
;/                 Inverse procedure
;/
;/
;/SUBr DEPENDENCE: None
;/INTERFACES: None
;/INPUT: None
;/OUTPUT: BOX:M8-MF on stack, Y, X, A, P in M8-MB; MC-MD=
;/        calling program address (3rd byte, JSR BOX); ME-MF=
;/        (SP+1,2) at JST BOX;X=0; carry reset; (Y)=MF on
;/        stack
;/        COX: reverse data movement (contents of MC-MD at
;/        JSR COX are lost)
;/REGs USED: None if COX used to restore them
;/STACK USE: BOX: +6; COX: -6
;/LENGTH: 53
;/TIME STATES: BOX: 297; COX: 299
;/PROCESSOR: 6502
;
BOX:    PHP           ;Push all registers           08
        PHA           ;                             48
        TXA           ;                             8A
        PHA           ;                             48
        TYA           ;                             98
        PHA           ;                             48
        CLC           ;Distinguish from COX         18
        BCC SOX       ;Go to exch stack, page zero  90 0E
VOX:    LDA MD        ;Replace return addr          A5 ZZ
        PHA           ; on                          48
        LDA MC        ; stack                       A5 ZZ
        PHA           ;  and                        48
        RTS           ;  return                     60
COX:    PLA           ;Put return address in MC,D   68
        STA MC        ;  for return after exch      85 ZZ
        PLA           ;  & restoration of regs      68
        STA MD        ;                             85 ZZ
        SEC           ;Distinguish from BOX         38
SOX:    TSX           ;Stack index into Y           BA
        TXA           ;                             8A
        TAY           ;                             A8
        LDX #$F8      ;Page zero index in X         A2 F8
LOX:    INY           ;Point at next byte and       C8
        LDA &0100,Y   ; exch with page zero byte    B9 00 01
        PHA           ;                             48
        LDA MF+1,X    ;                             B5 ZZ
        STA $0100,Y   ;                             99 00 01
        PLA           ;                             68
        STA MF+1,X    ;                             95 ZZ
        INX           ;Point at next page zero      E8
        BNE LOX       ;  & loop if not done         D0 F0
        BCC VOX       ;Jump if BOX                  90 DB
        PLA           ;Restore previous contents    68
        TAY           ;  of M8 to MB to the regs    A8
        PLA           ;                             68
        TAX           ;                             AA
        PLA           ;                             68
        PLP           ;                             28
        RTS           ;                             60
```

Z80 clock controller

Sub Set has come a long way without touching much on control routines, yet this is an area of microprocessing many of us would like to learn more about. The problem is that control routines can only be 'general-purpose' to those who have the devices they control and they can rarely be tested because the preparation of these routines for publication does not allow for the time and risks of my hardware interfacing.

The next Datasheet, a collection of routines for a real-time clock controller from Michael Jones of Broadstone, is included, untested, by way of an experiment. Let us know whether or not you find code of this kind interesting or useful. These routines are not heavily device dependent, requiring only a CTC, generating interrupts at 1 kHz.

Datasheet

```
;= ON, OFF, CLEAR, READ - real-time clock controller
;/CLASS: 2 (not position independent)
;/TIME CRITICAL? No except ISR
;/DESCRIPTION: Set of routines to turn on, turn off, clear
;/             & read a 1/1000 sec real-time clock using a spare
;/             CTC channel
;/ACTION: (ON) Initialise interrupt structure (mode 2);
;/             appropriate vector and CTC. Does not clear
;/             time automatically.  ISR increments memory,
;/             working from low to high address if carry. No
;/             check for overflow but 4-byte storage will last
;/             for about 7 weeks
;/       (OFF) Internally resets CTC
;/     (CLEAR)  Zeroes all four bytes
;/      (READ) Reads outvalues into DE, HL
;/SUBr DEPENDENCE: None
;/INTERFACES: Z80A CTC channel & 6 bytes RAM (4 for time &
;/            2 for vector)
;/INPUT: None
;/OUTPUT: (READ) HL= least significant word
;/               DE= most significant word
;/     (OTHERS) None
;/REGs USED: (READ) DE, HL
;/         (OTHERS) I set up by ON
;/STACK USE: 4,2,2,0 (+ 6 at any time for ISR
;/LENGTH:78
;/PROCESSOR: Z80 running at 2 or 4 MHz
;
```

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Thank you for the first issue of BEEBUG which I found excellent value. (T.S., Surrey)

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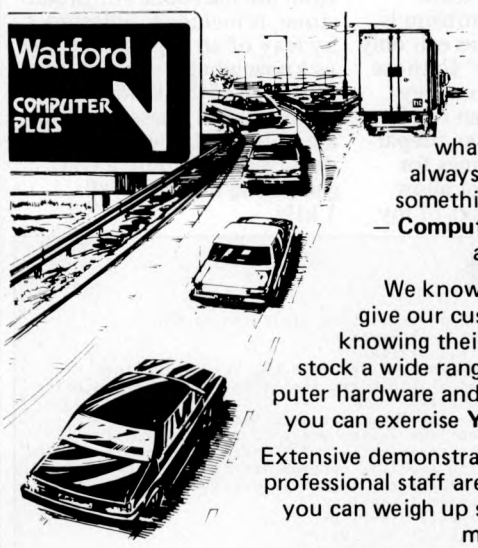

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```
VECT:   EQU   X           ;Location of interrupt vector in
                          ;  RAM (2 bytes)
RTIM:   EQU   X           ;Location of 4-byte time storage
CTCO:   EQU   X           ;CTC port on channel 0
CTCN:   EQU   X           ;CTC port free
ON:     PUSH  HL          ;Save registers          E5
        PUSH  AF          ;                        F5
        IM    2           ;Z80 vector mode         ED 5E
        LD    A,VECT/256  ;Initialise I with       3E XX
        LD    I,A         ;  top byte of vector    ED 47
        LD    HL,ISR      ;Initialise vector with  21 YY YY
        LD    (VECT),HL   ;  address of ISR        22 XX XX
        LD    A,VECT      ;Send low byte of        3E XX
        OUT   (CTCO),A    ;  vector to CTC         D3 XX
        LD    A,85H       ;Initialise CTC          3E 85
        OUT   (CTCN),A    ;  in timer mode         D3 XX
        LD    A,250       ;For 4 MHz sys or 125    3E FA
                          ;  for 2 MHz sys
        OUT   (CTCN),A    ;                        D3 XX
        POP   AF          ;Restore registers       F1
        POP   HL          ;                        E1
        RET               ;                        C9
;
ISR:    EI                ;Re-enable interrupts    FB
                          ;  interrupt response
        PUSH  HL          ;Save registers          E5
        PUSH  AF          ;                        F5
        LD    HL,RTIM     ;Start (LSD) of time     21 XX XX
LOOP:   INC   (HL)        ;Incr time               34
        INC   HL          ;Point to next digit     23
        JR    Z,LOOP      ;Incr next digit if carry 28 FC
        POP   AF          ;Restore registers       F1
        POP   HL          ;                        E1
        RETI              ;Return from interrupt   ED 4D
;
OFF:    PUSH  AF          ;Save AF                 F5
        LD    A,+3        ;To internally reset CTC 3E 03
        DI                ;Prevent spurious ints   F3
        OUT   (CTCN),A    ;                        D3 XX
        EI                ;Re-enable interrupts    FB
        POP   AF          ;                        F1
        RET               ;                        C9
;
CLEAR:  PUSH  HL          ;                        E5
        LD    HL,+0       ;Zero RAM                21 00 00
        LD    (RTIM),HL   ;                        22 XX XX
        LD    (RTIM+2),HL ;                        22 XX XX
        POP   HL          ;                        E1
        RET               ;                        C9
;
READ:   DI                ;Prevent time changing   F3
                          ;  while being read
        LD    HL,(RTIM)   ;Get low word            2A XX XX
        LD    DE,(RTIM+2) ;Get high word           ED 5B XX XX
        EI                ;Re-enable               FB
        RET               ;                        C9
```

6502 arithmetic

Continuing Vincent Fojut's improvements to the 6502 arithmetic routines, we have ABS4, to get the absolute values for 32-bit numbers and SMUL46, the 32-bit multiplication.

Before looking at these, I remind you that, for 6502 code, Sub Set routines have 16 bytes of zero-page RAM reserved for them, designated M0 - MF in the mnemonics and ZZ in the machine code. For this suite of routines, the first accumulator is in M0 - M3, the second in M4 - M7 and the third in M8 - MB. MC - MD points to ASCII strings, ME holds the sign of the product of the second and third accumulators and MF is available as a temporary store.

The original ABS4 (April '82) got the absolute values of the second and third accumulators, after moving them into the first accumulator. Vincent restructures this into two subroutines; a lower level one, ABSNEG, to deal with a 32-bit value without moving it, and the controlling one, ABS4. While functionally the same as the original, the new routines save 20 bytes and 242 T-states as well as a zero page storage location but make use of the Y register, which the original left untouched.

To save space, I have put ABS4 and ABSNEG together but, outside the magazine publishing world, they should be held and documented separately, since ABSNEG has wider application than its use by ABS4.

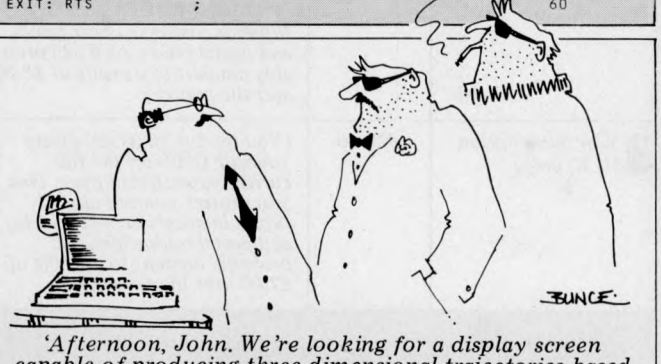
Datasheet

```
;=SMUL46 - 32-bit signed integer multiply
;/CLASS: 2
;/TIME CRITICAL? No
;/DESCRIPTION: Multiplies two 32-bit signed integers in M4-M7
  & M8-MB
;/ACTION: Get product sign & absolute values of arguments
;/        Clear accumulator
;/        Multiply accumulator by 2 & check for overflow
;/        Get next bit & if it's 1 add multiplicand to acc &
;/        check for overflow
;/        Repeat 32 times
;/        Negate ifproduct sign minus
;/INTERFACES: None
;/INPUT: Multiplicand in M8-MB,multiplier in M4-M7 with the
;/       mosty significant bytes in MB & M7
;/OUTPUT: No error: product in M0-M3; M4-M7=zero; M8-MB
;/        contains the absolute multiplicand; carry is reset
;/        Overflow: carry set;all 3 accs indeterminate
;/REGs USED: A,X,Y,P,M0-MB,ME
;/STACK USE: 4
;/LENGTH: 63
;/T-STATES: Min 1756, max 4134
;/PROCESSOR: 6502
;
SMUL46:JSR  ABS4      ;Get abs values & product      20 XX XX
       STX  M0        ;  sign, zeroise               86 ZZ
       STX  M1        ;  accumulator                 86 ZZ
       STX  M2        ;  withX                       86 ZZ
       STX  M3        ;  = 0                         86 ZZ
       LDY  £+32      ;Bit count                     A0 20
SML1:  ASL  M0        ;Shift                         06 ZZ
       ROL  M1        ;  left                        26 ZZ
       ROL  M2        ;  accumulator                 26 ZZ
       ROL  M3        ;                              26 ZZ
       BMI  OVFW3     ;Jump if                       30 26
       BCS  OVFW3     ;  overflow                    B0 24
       ASL  M4        ;Get next                      06 ZZ
       ROL  M5        ;  bit of                      26 ZZ
       ROL  M6        ;  multiplier                  26 ZZ
       ROL  M7        ;  into carry                  26 ZZ
       BCC  SML3      ;Skip if bit is a 0            90 0E
       LDX  £-4       ;Using negative                A2 FC
       CLC            ;  indexing,                   18
SML2:  LDA  M0+4,X    ;  add byte in acc             B5 ZZ
       ADC  M8+4,X    ;  to multiplicand             75 ZZ
       STA  M0+4,X    ;  & store in acc              95 ZZ
       INX            ;                              E8
       BMI  SML2      ;Continue if X = 0             30 F7
       BVS  OVFW3     ;Jump if overflow              70 0C
SML3:  DEY            ;Repeat                        88
       BNE  SML1      ;  32 times                    D0 D9
       BIT  ME        ;Test product sign             24 ZZ
       BPL  SML4      ;Skip if positive              10 03
       JSR  SNEG46    ;  else negate                 20 XX XX
SML4:  CLC            ;Clear carry to show OK        18
       RTS            ;                              60
OVFW3: SEC            ;Set carry to show error       38
       RTS            ;                              60
```

In the multiplication, negative indexing at SML2 saves eight bytes, a zero page storage location and, in the worst possible case, 1013 T-states.

Datasheet

```
;=ABS4 - Get absolute values of two 4-byte numbers
;/CLASS: 2
;/TIME CRITICAL? No
;/DESCRIPTION: Gets abs valueof two 32-bit accumulators
;/             in page zero of RAM, leaving X=0 & the sign of
;/             product of the accumulators in ME
;/ACTION: Exclusive OR the most sig bytes of the accs & store
;/        in ME.  Point to each acc in turn & call ABSNEG to
;/        negate if necesssary
;/SUBr DEPENDENCE: local ABSNEG
;/INTERFACES: None
;/INPUT: 2nd (M4-M7) & 3rd accs, which are 32-bit signed numbers
;/       with their most sig bytes in M7 & MB
;/OUTPUT: 2nd & 3rd accs contain their absolute values; X=0;
;/        ME has sign of the product of the 2nd & 3rd accs
;/REGs USED: A,X,Y,P,M4-M7,M8-MB,ME
;/STACK USE: 2
;/LENGTH: 37
;/TIME STATES: 33+2*ABSNEG t-states (83 when a number neg,
;/             13 when positive
;/PROCESSOR: 6502
;
ABS4: LDA  M7       ;Get 2nd acc sign &            A5 ZZ
      EOR  MB       ;  XOR with 3rd acc sign       45 ZZ
      STA  ME       ;Store in ME                   85 ZZ
      LDX  £M4      ;Set pointer to 2nd acc &      A2 ZZ
      JSR  ABSNEG   ;  negate if necc              20 YY YY
      LDX  £M8      ;Set up pointer to 3rd acc     A2 ZZ
      JSR  ABSNEG   ;  & negate if necc            20 YY YY
      LDX  £+0      ;Zeroise X                     A2 00
      RTS           ;                              60
;
ABSNEG:LDA 03,X     ;Get msb of acc                B5 03
      BPL  EXIT     ;Exit if positive              10 0D
      LDY  £+4      ;Initialide counter            A0 04
      SEC           ;Prepare to subtract with no   38
ABNG1:LDA  £+0      ;  borrow.  Subtract           A9 00
      SBC  00,X     ;  accumulator                 F5 00
      STA  00,X     ;  from                        95 00
      INX           ;  zero                        E8
      DEY           ;Decr counter                  88
      BNE  ABNG1    ;Continue if not = 0           D0 F6
EXIT: RTS           ;                              60
```



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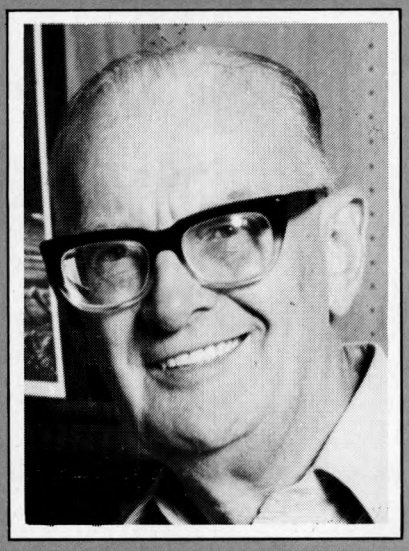

It's amazing what goes on in the basement of *Personal Computer World*. Our erstwhile subscriptions manager, for example, engaging in correspondence with Arthur C Clarke! (For the uninitiated few, ACC is arguably one of the world's most visionary living individuals: a scientist, author of 2001: A SPACE ODYSSEY and 60 or so other works, originator of communications satellites, undersea explorer, etc, etc).

Mr Clarke tells us that he has an Apple II 'languishing in the lab. . . too busy to touch it for weeks'. Busy, apparently, completing SPACE ODYSSEY two ('my *latest*, last book!') on his Archie word processor (Archives III, 5 megabyte Winchester disk, Wordstar program) with which he is obviously deeply satisfied — 'I could no more imagine going back to a typewriter than to a slide rule. . .'.

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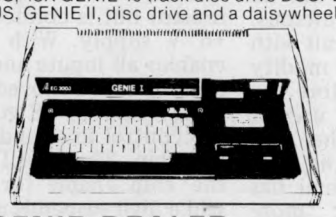

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CLOCK IT TO ME

In the first instalment of a two-part article, Bruce Marriott describes a real-time clock/calendar card for the Apple II

Many programs require time and date information: either directly, as in tagging output for later identification, or for generating or measuring accurate intervals of time — as, for instance, in scientific data logging.

In the former case, the user can be asked to input the time and date but this is irksome and error-prone since it has to be done at least once for every program run. For generating or measuring time intervals, recourse is often made to assembler or Basic timing loops, the programming of which is complex and hard to modify. Since computers are used to increase efficiency, an automatic (and cheap!) solution to such routine requirements would be particularly useful: this is what led to this design for a clock/calendar card.

This month I shall cover the hardware design of the real-time card; next month I shall go on to describe suitable driving software. Depending on which system is being used, and the chosen construction method, the cost of the card varies between £15 and £35. As usual with such articles, complete details are only given for one machine, in this case the Apple II. Don't let this dissuade you from reading on if you own another micro — the hardware itself is not complex and some information on implementing the design for other machines is given.

The Apple II uses the 6502 processor, so the design will be easiest to adapt to other 6502-based machines; owners of 8080/Z80 machines will have to work a little harder — but again, the comparative simplicity of the hardware cannot be overemphasised.

Background

There are several methods for implementing a real-time clock on a micro. The easiest is to generate regular interrupts (at least once a second) and have an operating system which counts the interrupts into time (and possibly date) registers in a reserved area of memory. This system — used in several micros — is fine until the power is turned off; the clock has to be reset every time you turn the machine on.

Until two or three years ago the only other practical method was to implement a design totally in discrete hardware using a crystal timebase and a host of TTL chips, with power supplied by rechargeable batteries. This method is used in the Mountain Computer clock/calendar card for the Apple II and suffers from two drawbacks: cost (£149) and excessive power consumption, requiring an AC charger which has to be left permanently on, more or less.

The most satisfactory solution came with low-power CMOS clock/calendar chips specifically designed to interface to micro buses. These chips typically use a 32768 Hz crystal as a timebase and will continue to operate on about 20 microAmps at 2.2 volts, supplied by battery backup which should last for months. Access to the time and date registers is usually through 4-bit address and data lines.

One of the first of these chips was the National Semiconductor MM58174A, which has been described for use in a number of articles. Unfortunately it suffers from a serious flaw: it has no year register, which seems ludicrous. You either have to design a circuit with CMOS RAM to hold the year, or modify the disk operating system to store the year on all disks. Otherwise the user of an applications program is, rather perplexingly, asked to enter just the year instead of the full date. NatSemi has recently produced a rather more sophisticated chip, the MM58167A, but this too lacks a year register!

Casting around for a better device to use for this design produced the Oki MSM5832RS. This chip has no serious drawbacks and, surprisingly, has been available for two years, though it would seem to be used only in professional circles. After opting for the Oki chip, I have heard of a Motorola device, the MC146818, and this might be worth checking out as it has a very advanced specification. It is, however, rather expensive — about £15 one-off.

MSM5832 anatomy

Figure 1 shows the functional block diagram and pin-out of the 5832. The chip interface breaks down into three broad areas: supply requirements, control systems, and data and address lines.

The supply requirements are a 3276 Hz crystal across $\overline{XT}$ and XT and +5 volts at Vcc when being accessed, or a minimum of 2.2 volts when on standby (ie, when supplied from a battery).

The major control signals are HOLD, READ, WRITE and CS (chip select). The CS input is rather unusual in that it is not normally connected to the micro bus or tied to a power rail through a resistor but is connected directly to the +5 V supply. With +5 V applied, CS enables all inputs and outputs but when the power is removed (but battery backup is working) CS goes low, disables all the control lines and effectively isolates the chip. The HOLD line is effectively the chip enable (or select) signal and while high suspends updating of registers so that stable conditions exist for reading from or writing to the chip. The READ line goes high to enable reading data from the chip and WRITE goes high to enable writing data.

Two other control signals exist, neither of which is normally used. The ± 30 ADJ input, when briefly taken high, resets the seconds register to zero and if there were more than 30 seconds, the number of minutes is increased by one, otherwise the minutes are left unchanged. The TEST input, as its name implies, is used for testing; with CS high, pulsing high signals on this pin will directly clock certain registers depending on the addressing used.

The last group of signals comprises the address and data lines, which follow normal practice with the address lines selecting a specific register within the 5832 and the data lines actually passing the contents. Figure 2 shows the register

ADDRESS INPUTS					INTERNAL COUNTER	DATA I/O				DATA LIMITS	NOTES
HEX	A3	A2	A1	A0		D0	D1	D2	D3		
0	0	0	0	0	S	*	*	*	*	0∿9	S1 or S10 are reset to zero irrespective of input data D0∿D3 when write instruction is executed with address selection.
1	0	0	0	1	S 10	*	*	*		0∿5	
2	0	0	1	0	MI 1	*	*	*	*	0∿9	
3	0	0	1	1	MI 10	*	*	*		0∿5	
4	0	1	0	0	H 1	*	*	*	*	0∿9	
5	0	1	0	1	H 10	*	*	†	†	0∿1 / 0∿2	D2 = "1" for PM, D2 = "0" for AM; D3 = "1" for 24 hour format, D3 = "0" for 12 hour format
6	0	1	1	0	W	*	*	*		0∿6	(Day of the week)
7	0	1	1	1	D 1	*	*	*	*	0∿9	
8	1	0	0	0	D 10	*	*	†		0∿3	
9	1	0	0	1	M0 1	*	*	*	*	0∿9	
A	1	0	1	0	M0 10	*				0 1	
B	1	0	1	1	Y 1	*	*	*	*	0∿9	
C	1	1	0	0	Y 10	*	*	*	*	0∿9	

(1) *data valid as "0" or "1".

Blank does not exist (unrecognized during a write and held at "0" during a read)

† databits used for AM/PM, 12/24 HOUR and leap year.

(2) If D2 previously set to "1" upon completion of month 2 day 29, D2 will be internally reset to "0".

Fig 2 MSM5832 register addressing

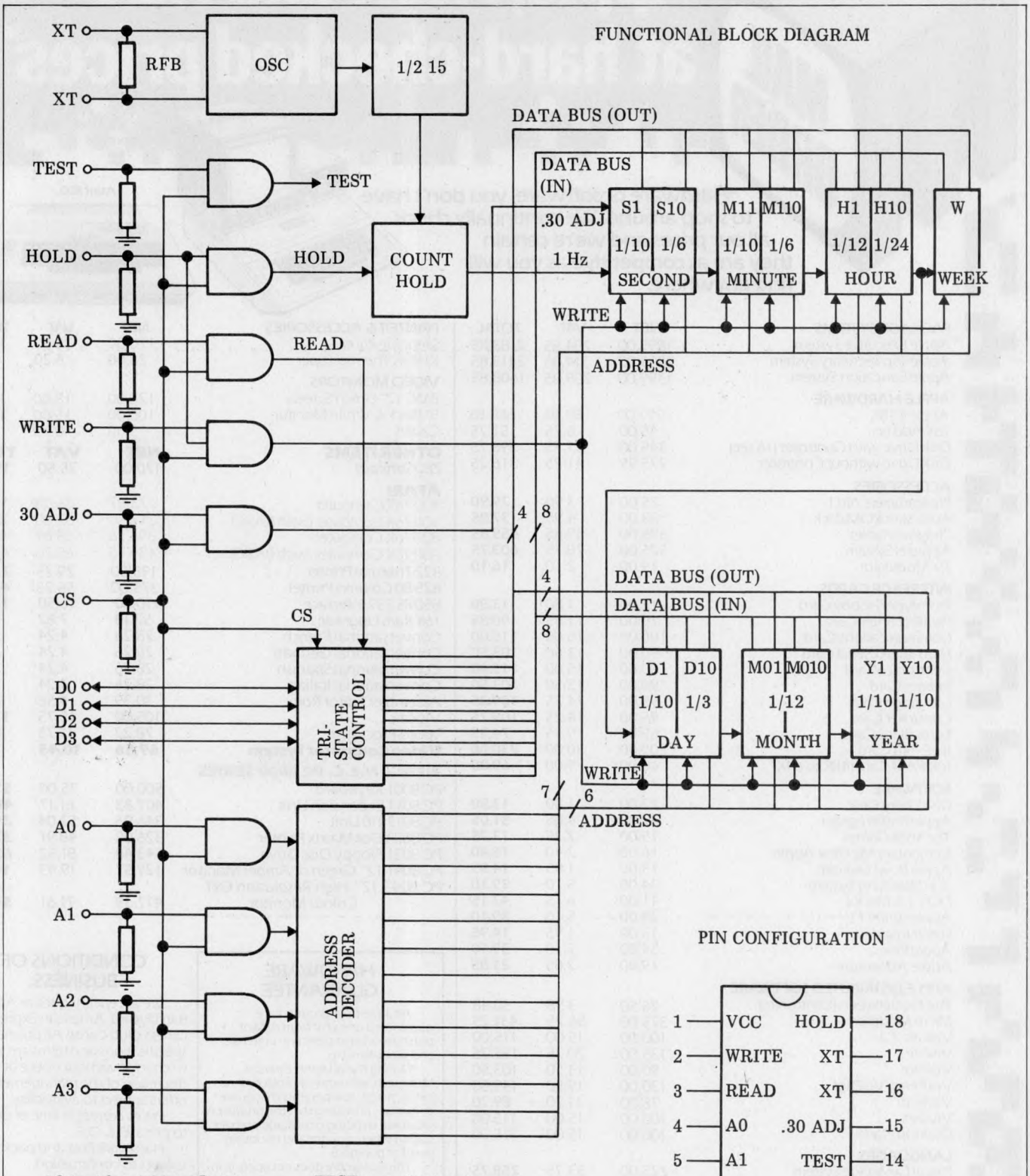
addresses; note that two registers (tens of hours and tens of days) not only hold time and date digits but also use some bits for control of time format and leap years.

One facility of the 5832 which is not apparent from the pinout is the chip's ability to generate interrupts. These appear on the data lines under specific control and address line conditions, as shown in Figure 3.

Interfacing

The easiest way to interface the 5832 to most popular systems is to use a 6821 PIA (Peripheral Interface Adaptor) for 6800/6502 systems or the equivalent 8255 PPI (Programmable Peripheral Interface) for 8080/Z80 based systems. The Oki data sheet shows the way with a 'typical application' based on the 8255.

An advantage with using a PIA/PPI is that the normally critical timing constraints involved with discrete logic interfacing are no longer a problem as timing moves from the microsecond



A0 to A3:	Address Inputs	TEST:	Test Input
WRITE:	Write Enable	±30 ADJ:	±30 Second Correction Input
READ:	Read Enable	XT & XT:	xtal oscillator connections
HOLD:	Count Hold Enable		
CS:	Chip Select	GND:	Ground
D0 to D3	Data Input Output	VCC:	+5V supply

PIN CONFIGURATION

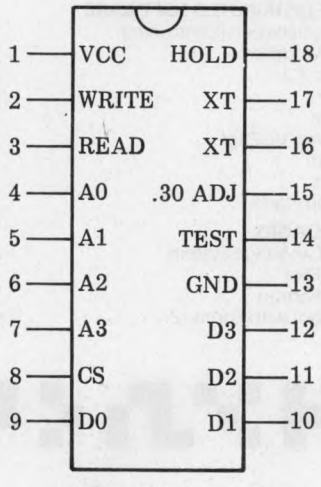
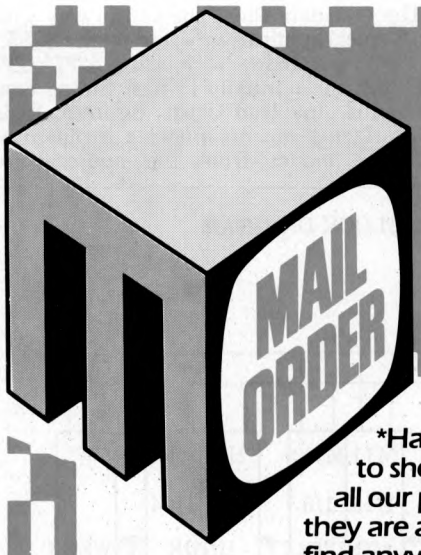


Fig 1.



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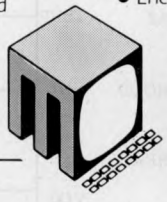

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domain to the processor's clock and instruction times, which are much longer. For instance, to write to the 5832 using a direct design would need HOLD to go high for 150 microseconds before the address and data with the actual WRITE pulse following within a minimum of 0.5 microseconds and lasting at least 1 microsecond. With a PIA/PPI, everything is slowed down to the speed that instructions can be given and these in all cases will be longer than the minimum times given.

Another advantage of a PIA/PPI is that this is the most popular addition to a system (with the exception of memory chips) and hence for most readers will be a known entity. With a 6821 device, as used here, the interrupt inputs are available, allowing the 5832's interrupt capabilities to be exploited under software control rather than by jumper leads.

Figure 4 shows the 'typical application' design from the 5832 data sheet. I haven't tried this so I can't guarantee its correct operation, but it should give a good start for 8080/Z80 users.

PIA design

For 6800/6502 systems, the 6821 PIA is the easiest chip to use. Figure 5 shows the complete circuit diagram for the Apple II. The heart of the system has been heavily outlined and is usable on any system, so I'll talk about this first. I assume that you know how to interface a 6821 to your particular system; if not, then get a book on your processor or, even better, one on interfacing to your particular computer system.

Connection between the two 8-bit PIA ports and the 5832 requires some consideration because the ports are not identical and this can affect the 5832 when the 6831 PIA is reset. The critical line is HOLD which, when taken high, stops the 5832 updating its registers. When a 6821 PIA is reset, both A and B ports become inputs but the A port has internal pullup resistors while the B side doesn't. The net effect of this is that should the HOLD line be connected to the A side of the PIA resetting the system will take HOLD high and stop the clock. Hence the control lines shown in Figure 5 have been connected to the PIA's B side.

As discussed earlier, the four data lines have a dual function: moving actual register contents and acting as constant interrupt sources (Figure 3). For data flow handling they are connected to port B but, in addition, the lines are also connected to the four interrupt ports (CA1, CA2, CB1, CB2) through which their interrupt signals can be software controlled.

Power-off operation comes from a 3.5 V 100 mAh Nicad battery which is automatically trickle-charged during normal use. Precise setting of the required clock frequency is achieved with a variable capacitor. Two stitches are used in this design: one allows the use of the ± 30 second adjust mentioned earlier while the other write-protects the 5832.

Apple extension

The ports outside the heavily lined area in Figure 5 are specific to the Apple II. The Apple has a unique I/O structure which, considering the age of the design, is quite exemplary. At the back of the Apple are eight slots for peripheral cards. Slots 0 and 7 are unique and have specialist uses but the other six can generally be used by any Apple-compatible card. Each slot has 16 locations for general I/O and a 256-byte page of memory which is normally used to hold the card's driving program. The 256-byte page is corrected to Basic via the IN# (slot number) command which, when processed, means that the peripheral card in that slot will respond to subsequent INPUT statements instead of the keyboard. It's clearly much neater to use INPUT TIME$, DATE$ rather than resorting to the usual PEEKs and POKEs, so the circuitry to do this has been included.

The driving program is housed in a single rail 2716 EPROM which is both cheap and relatively easy to program. This is a 2k device, so eight 256-byte driving programs could be contained within it. As I don't think anyone will need that many, the highest 2716 address line (A10) has been permanently connected to ground, so only four spaces are available, and are conveniently decoded by switches 1 and 2.

Output enable for the EPROM comes from the Apple-supplied $\overline{\text{I/O SEL}}$ line which is fully decoded for each of the slots. The 6821 PIA is mapped into four of the 16 general I/O locations which have an equivalent chip select signal called $\overline{\text{DEVSEL}}$.

Most signals available at each slot in the Apple are capable of driving several LSTTL loads with the exception of the data lines which can drive only one such load. Although the design would probably work without buffering, I decided to play safe and an LS245 tri-state buffer has been incorporated. Chip select for this device (G) is derived from an LS08 (AND gate) and the two Apple lines $\overline{\text{DEVSEL}}$ and $\overline{\text{I/O SEL}}$. All other connections are standard.

Construction

The circuit can either be constructed on an Apple-compatible prototyping board

CONDITIONS	OUTPUT	FREQUENCY	PULSE WIDTH
HOLD = L	D0 (1)	1024 Hz	duty 50%
READ = H	D1	1 Hz	122.1 µS
C.S. = H	D2	1/60 Hz	122.1 µS
A0 ∿ A3 = H	D3	1/3600 Hz	122.1 µS

(1) 1024 Hz signal at D0 not dependent on HOLD input level

Fig 3 Control of MSM5832 interrupt facility.

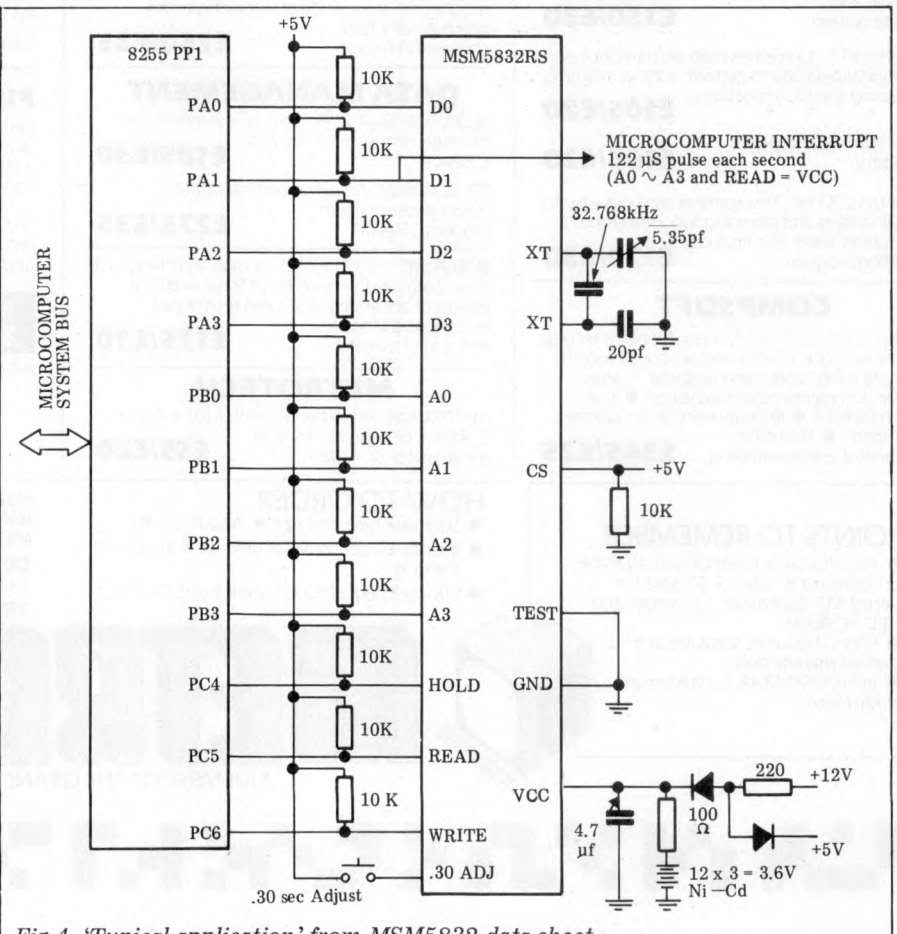


Fig 4 'Typical application' from MSM5832 data sheet

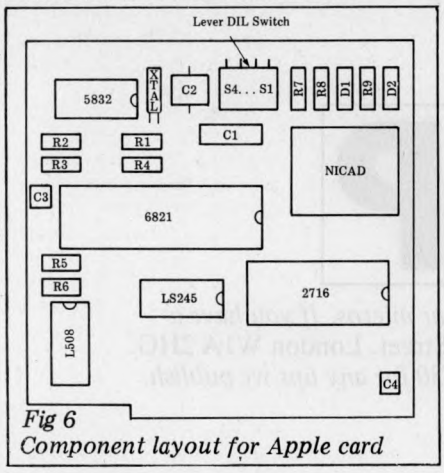


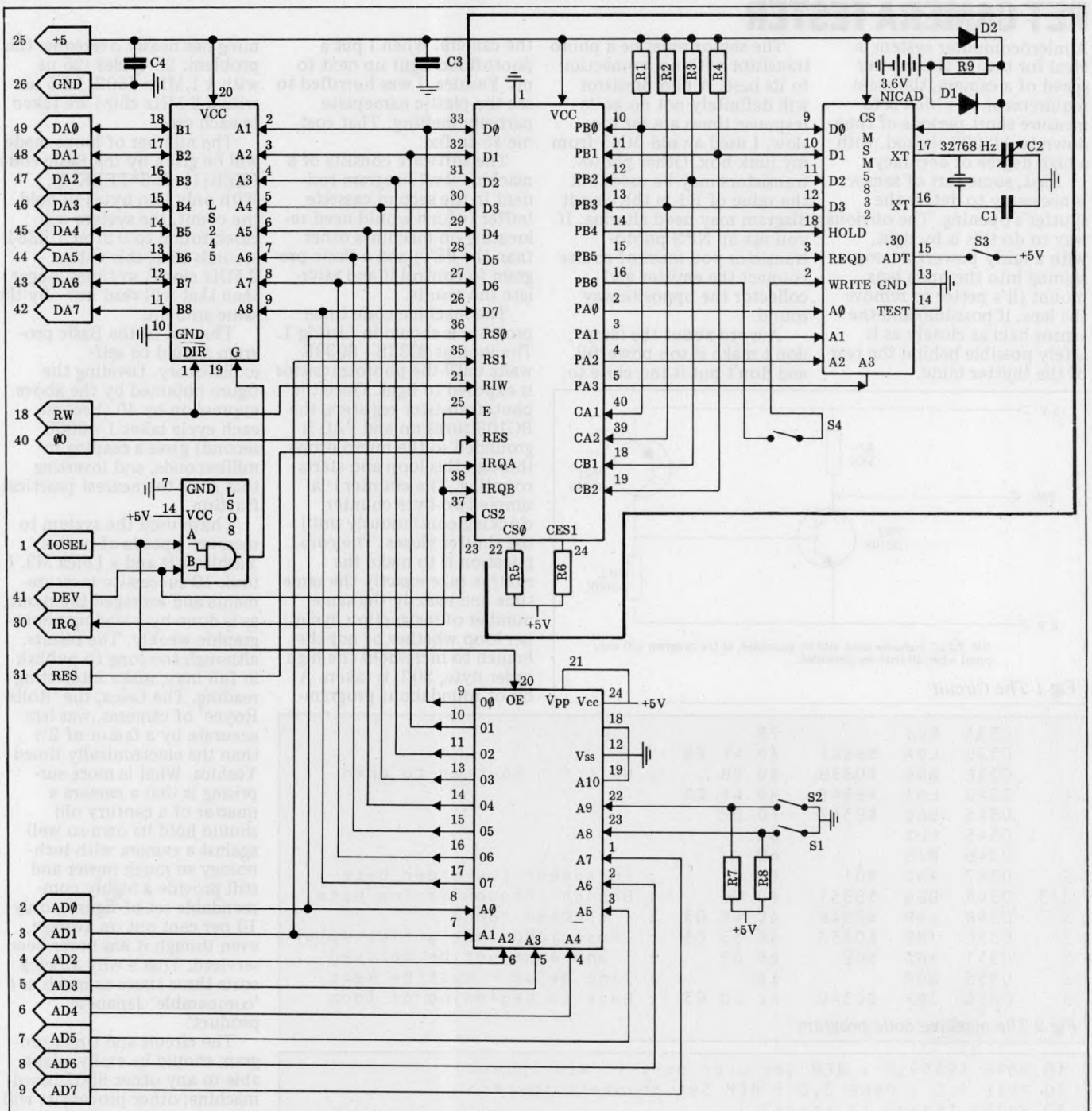
Fig 6
Component layout for Apple card

or, rather more easily and with less chance of errors, on the double-sided, through-plated PCB which is available for this project — see the 'Suppliers' section at the end of this article for details. Figure 6 shows the component layout for this card and this can probably be used as a guide if you're using a prototype board.

Start constructing the board by mounting the resistors, diodes and the crystal. Then add the DIL socket followed by the capacitors, DIL switch and battery. Finally, add the ICs, remembering that the 5832 is a CMOS device and needs careful handling, and make sure that they are all correctly oriented. As a final safeguard, before powering up, check that all components have been mounted properly and carefully inspect the tracks for any bridging.

Suppliers

A partial kit of parts comprising: double-sided, through-plated PCB, MSM5832, programmed EPROM, Nicad, DIL switch, DOS 3.3 (48k) disk and manual is available for £28 (inc p&p) plus VAT from Capital Computers Ltd, 1 Branch Road, Park Street, St. Albans. A complete kit is also available, costing £36 (inc. p&p) plus VAT. For anyone wanting to experiment, Technomatic Ltd stocks the MSM5832 and the Nicad, both of which are rather difficult to get hold of.



PARTS LIST

R1,2,3,4	= 10K ¼4W	C3	= 0.1 µf Disc	LS245
R5,6,7,8	= 3.9K ¼W	C4	= 4.7 µf Tantalum	2716
R9	= 100 ¼W			6821
D1,D2	= ORΩ7	*S1,2,3,4	= Single pole lever type 4-way DIL switch	Oki MSM5832 RS
C1	= 20 pf MICA		3.6 Volt 100mAh PCB Battery	32768 Hz XTAL
*C2	= 5.5 — 65 pf trimmer	LC508		40 pin DIL Swt
				24 "
				20 "
				18 "

Fig 5 MSM5832 interface to Apple II.

TJ's WORKSHOP

Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to: 'TJ's Workshop', *PCW*, 62, Oxford Street, London W1A 2HG. *Please keep your contributions as concise as possible. We will pay £5-£30 for any tips we publish.*

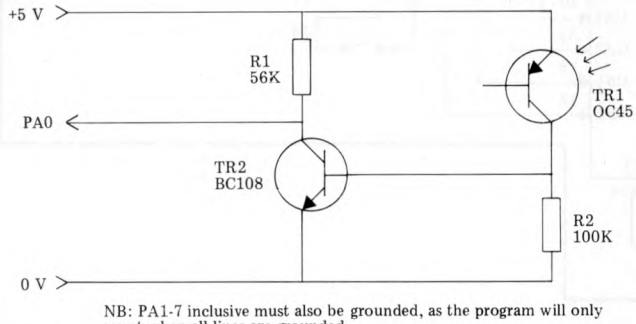
PET CAMERA TESTER

A microcomputer system is ideal for testing the shutter speed of a camera, the main requirement of which is to measure short periods of time, down to 1/2000 second, with a high degree of accuracy.

First, some sort of sensor is necessary to detect the shutter's opening. The obvious way to do this is by light, with a fairly powerful lamp shining into the open lens mount (it's better to remove the lens, if possible) and the sensor held as closely as is safely possible behind the rear of the shutter blind.

The sensor must be a phototransistor with no connection to its base. A photoresistor will definitely not do as its response times are far too slow. I used an old 0C45 from my junk box. Other phototransistors may be used, but the value of R1 in the circuit diagram may need altering. If you use an NPN phototransistor you must of course connect the emitter and collector the opposite way round.

A word about the lamp: don't make it too powerful and don't put it too close to the camera. When I put a photoflood right up next to my Yashica, I was horrified to see the plastic nameplate partially melting! That cost me £5 to fix.



NB: PA1-7 inclusive must also be grounded, as the program will only count when all lines are grounded.

Fig 1 The Circuit

The software consists of a machine-level program resident in the second cassette buffer (which would need relocating on machines other than the PET) and a Basic program to control it and tabulate the results.

The machine code timer program is shown in Listing 1. The loop at $033B - $033E waits until the phototransistor is exposed to light. Once the phototransistor registers, the BC108 turns on and PA0 is grounded so the micro drops through this loop and starts counting. The counter is a simple two-byte counter, clocking continuously until the shutter closes. The complication is to make the routine take exactly the same time and exactly the same number of instruction cycles per loop whether or not the branch to increment the high order byte, $02, is taken. A bit of roundabout programming has neatly overcome this problem: 25 cycles (25 us with a 1 MHz 6502, 12.5 us with a 2 MHz chip) are taken in each case.

The number of loops made will be given by the Basic code PEEK(1)+256*PEEK(2). With only two bytes to hold the count, the system will clock round to 0 after 1.6384 seconds (half this with a 2 MHz clock) so times longer than that will read low by the same amount.

The rest of the Basic program should be self-explanatory. Dividing the figure obtained by the above expression by 40 (because each cycle takes 1/40000 second) gives a reading in milliseconds, and inverting that gives the nearest practical fraction.

I have used the system to measure speeds of both a Yashica FR and a Leica M3. I took 10 successive measurements and averaged them out, as is done by a leading photographic weekly. The results, although too long to publish in full here, make interesting reading. The Leica, the 'Rolls-Royce' of cameras, was less accurate by a factor of 2½ than the electronically timed Yashica. What is more surprising is that a camera a quarter of a century old should hold its own so well against a camera with technology so much newer and still provide a highly commendable set of figures, only 10 per cent out on average, even though it has never been serviced. That's why a Leica costs three times as much as a 'comparable' Japanese product!

The circuit and timer program should be easily adaptable to any other 6502-based machine; other processors will require a simple rewrite. And with different circuitry attached, the timer program must have a thousand other applications.

Kevin Jones

```
      033A  SEI           78
      033B  LDA  $E84F     AD 4F E8
      033E  BNE  $033B     D0 FB      ; Wait for shutter to open
4     0340  LDA  $E84F     AD 4F E8
3     0343  BEQ  $0347     F0 02
      0345  CLI            58
      0346  RTS            60
5     0347  INC  $01       E6 01      ; Increment low order byte
2/3   0349  BEQ  $0351     F0 06      ; Branch through if low byte
3     034B  JMP  $034E     4C 4E 03   ;   clocked round
3     034E  JMP  $0353     4C 53 03   ; These jumps are a time delay
5     0351  INC  $02       E6 02      ;   and must not be delayed
2     0353  NOP            EA         ; Time delay - must be kept
3     0354  JMP  $0340     4C 40 03   ; Back to beginning of loop
```

Fig 2 The machine code program

```
10 POKE 49459,0 : REM Set user port to all inputs
20 POKE 1,0 : POKE 2,0 : REM Set counters to zero
30 PRINT "Ready to start"
40 SYS 826
50 T=(PEEK(1)+256*PEEK(2))/40 : REM Div by 80 if 2 MHz clck
60 PRINT "Time taken = ";T;" milliseconds"
70 PRINT "= 1/";INT(1000/T+.5);" second"
80 GOTO 20
```

Fig 3 Basic program

TJ's WORKSHOP

UK101 QUIRKS

Has anyone else noticed these quirks on the UK101's new monitor (UK02)?

Clear the screen so that the cursor is in the top right-hand corner. Press Cursor Up (Ctrl-K) a number of times and the machine will allow you to backspace for that same number, wrapping around the bottom of the screen (up to a maximum of 72). With the cursor in this position, press Cursor Up again and a ' ' will appear, replacing the Cursor Up character. This will also cursor up, resulting in a diagonal line of these characters wrapping round the top of the screen. After 72 of these the 'Maximum Line Length' character will appear. After 48 of these characters the whole screen will start moving upwards. When this is done the computer will do some processing and the cursor will appear on the top line of the screen. Press any key and the machine will perform many carriage returns, leaving the cursor on the top line again in the left-hand corner. If Return is pressed there is a noticeable delay while the computer processes the lines.

Some variations on the theme are to press Return while in the diagonal line stage. Doing this many times will result in the cursor wrapping round the bottom of the screen. Try pressing Return, then enter a program line with Cursor Ups at the end of it. Now try listing it. If keys are pressed while the screen is moving upwards, when the cursor reaches the bottom of the screen Ctrl-K will make the cursor move upwards and wrap over the screen.

Matthew Phillips

REDUNDANT RESET

Here is a method for ascertaining filenames of Tangerine Microtan programs without having to use RESET.

If the program is saved at fast speed, type

```
0 POKE 14,0 : POKE 22,2 :
  INPUT F$ : PRINT F$
RUN
```

and press PLAY on the tape recorder. The computer will display the filename followed by the suffix .B and some garbage.

If the program is saved at slow speed, then alter the line to read

```
0 POKE 14,1 : .....
```

and proceed as above.

This cannot be done in command mode, as this will produce a 'syntax error' message for some reason.

On very short programs the filename will not be given first time around; in this case do not press BREAK, but rewind the tape and press PLAY again.

Jon Strutt

BEEB CHARACTERS

I read Malcolm Howlett's BBC Character Generator program (July '82) with interest and, I must admit, a little irritation as he had beaten me to getting a similar program published. I typed in the program and ran it, finding it to be a very useful addition.

I suggest that to make it easier to operate the cursor the following modifications could be made:

1) Add line 22960 to read
22960*FX 4,1
2) Change lines 23100 to 23400 to read
23100 IF ASC(C$)=139 THEN Y=Y-1
23200 IF ASC(C$)=138 THEN Y=Y+1
23300 IF ASC(C$)=136 THEN X=X-1
23400 IF ASC(C$)=137 THEN X=X+1
3) Add line 23405 to read
23405*FX 4,0
4) Delete lines 31120 and 31125.
5) Delete the A and D characters from line 31122.

These modifications disable the editing cursor keys and make them return an ASCII code. Line 23405 restores them to normal operation.

P Clayton

TRS-80 COMPUTED RESTORE

It is often useful to start READing data from a particular point rather than from the start of the DATA lists. This can be done by using RESTORE and then skipping over the unwanted data with a FOR-NEXT loop, but this is slow; if more data is added the numbers need to be changed.

This program allows you to specify a line number and, next time the READ command is used, the data assigned will be from that line (or the first line after it that has DATA). It is in machine code: to enter it simply type the three-line Basic subroutine shown in Listing 1 at the end of your program, and GOSUB 65520 at the start.

Then, to RESTORE at a line number, use the command DU=USR(X) where X is a line number and DU a dummy variable. X can, of course, be a constant, a variable or an expression, allowing the user to RESTORE at different line numbers depending on the value of the expression.

There are two limitations:
1) The line number cannot be greater than 32767; if it is this will result in an OV error.
2) If text entered in response to an INPUT command is over 205 characters long it will destroy part of the machine code program. It is very rare that such long inputs are needed: if they are simply add GOSUB 65520 after the INPUT command in your Basic program.

Briefly, the Basic program is scanned until:
a) the correct line is found;
b) the correct line is not found, so the next line after it is used;
c) the end of the Basic program is reached.

The data pointer (locations 16639 LSB/16640 MSB) is then set to the end of the previous line.

An assembly listing is provided which shows how it works in detail.

Steve Goldman

```
        ORG   17080          ;End of direct command RAM
RESTOR  CALL  2687           ;Get argument (line no)...
        EX    DE,HL          ;...into DE
        LD    BC,17129       ;Start of Basic program
LINE    PUSH  BC             ;Store program pointer
        POP   IX             ;  in IX
        LD    L,(IX+2)       ;Get current
        LD    H,(IX+3)       ;  line number
        OR    A              ;Reset carry
        SBC   HL,DE          ;Comp current line no to
                             ;  that wanted
        JP    P,COMP         ;If correct, go to adjust
                             ;  routine
        LD    C,(IX)         ;Get next
        LD    B,(IX+1)       ;  line pointer
        LD    A,B            ;If it isn't zero
        OR    C              ;  loop to check
        JR    NZ,LINE        ;  next line
COMP    DEC   IX             ;Point to end of last line
        LD    (16639),IX     ;Adjust data pointer
        RET                  ;Back to Basic
        END
```

Listing 2 Assembler listing

```
65520 DATA 205,127,10,235,1,233,66,197,221,225,221,110,2,221,
      102,3,183,237,82,242,216,66,221,78,0,221,70,1,120,177,
      32,231,221,43,221,34,255,64,201
65521 FOR L=0 TO 38:READ DA: POKE 17080+L,DA:NEXT
65522 POKE 16526,184:POKE 16527,66:RETURN
```

Listing 1 Basic subroutine to load machine code

POKE SUBSTITUTE

To anyone mourning the lack of a standard PEEK and POKE on the BBC Computer, I suggest they include the following declarations in their programs:

```
DEFPROCPOKE(A,B)?A=B:
  ENDPROC
DEFFNPEEK(A)=?A
```

One can POKE by saying PROCPOKE (address, data) and PEEK by saying data = FNPEEK (address).

At least these look vaguely like the familiar forms. Naturally, getting the hang of the ! and ? operators is better in the long term.

Andrew Civil

TJ's WORKSHOP

BBC ASSEMBLER AIDS

The assembler built in to BBC Basic does not appear to offer the pseudo operations used in stand-alone assemblers for declaring strings or byte data without the assembled within the assembled code. Although bytes can be initialised, it is necessary to leave the assembler and POKE the values, using the assembly pointer P%, and then correctly adjust the pointer before resuming assembly. This can make construction of large assembler programs rather cumbersome.

The two functions presented here can be used as rough equivalents of pseudo operations, to initialise strings and sequences of data bytes simply.

Function "defstring" initialises a section of memory to hold a string. The function has two parameters: the first is the string itself, and the second is a number specifying the format in which it is to be stored. The routine provides four possibilities:
format=0 stores the string and adds a RETURN (&0D) byte at the end.
format=1 stores the string and adds a zero byte at the end.
format=2 stores the string after a byte containing the length of the string.
format=3 stores the string without embellishment.

The value returned by the function is the address of the first byte it plants, so that text = FNdefstring("Here is a message",0) will store the text, followed by an &0D byte, and adjust P% to point to the next byte to be used by the assembler. The variable "text" will contain the address of the leading "H" character.

Function "defbytes" initialises one or more bytes to numeric values. The caller passes a list of the values as a string (Basic does not permit a function to have a variable number of parameters, so the numbers have to be set as a string and unpacked by the routine). Each element can be any numeric expression: the 1s byte will be stored. Assembler labels (which are Basic variables) van be used, but forward references can't be handled, so labels thus used should be given (arbitrary) values before the assembly begins. After pass one they will have their correct values. Again, the value returned by the routine is the address of the first byte planted. So numbers = FNdefbytes ("3,&27,&FF,1") will initialise four consecutive bytes, and the variable "numbers" will contain the address of the first of them.

The example program presents the listing of the two functions and an example of their use. The program will clear the screen and move the text cursor to (10,15) by the equivalent of the Basic statements
VDU 12
VDU 31,10,15
which involves writing the successive bytes to the OSWRCH routine at &FFEE. The program then prints 'Assembler Rules OK' and stops.

The functions themselves are quite simple and need little explanation. In defstring, the work is done in one IF statement at line 10030. The caller's string is copied to a 'fixed string' starting at the byte pointed by P% (specified by the $P% construction). This adds a &0D to the string and so no more is done for format 0. For format 1, the string has a CHR$0 concatenated with it before it is assigned to a fixed string, and the &0D is subsequently removed. The value of P% is adjusted to point to the byte after the string, allowing for any byte following.

Function defbytes consists of two nested REPEAT loops. The inner loop slices the string into the numeric elements, and the outer pokes the values obtained and increments P% each time.

Alan Phillips

```
  100 DIM code 100
  120 FOR I% = 0 TO 3 STEP 3
  140   P%=code              : REM set assembler ptr
  160   [OPT I%
  180   .doit
  200     LDY #0             \ ptr to list of bytes
  220   .nextvdu
  240     LDA vdubytes,Y     \ get next byte
  260     JSR &FFEE          \ send it to vdu driver
  280     INY                \ step the pointer
  300     CPY #4             \ stop when Y=4
  320     BNE nextvdu
  340     LDY #0             \ now set text ptr
  360   .nextchar
  370     LDA text,Y
  380     JSR &FFE3          \ output it with osascii
  400     CMP #&0D           \ was it RETURN?
  420     BEQ end            \ finish if it was
  440     INY                \ else move pointer on
  460     JMP nextchar       \ and carry on
  480   .end
  500     RTS                \ finished
  520   ]
  540   REM
  560   REM DEFINE BYTES AND TEXT - INSIDE
  580   REM THE TWO PASS LOOP SO THE ADDRESSES
  600   REM ARE KNOWN BY PASS 2 TIME
  620   REM
  640   vdubytes=FNdefbytes("12,31,10,15")
  660   text=FNdefstring("Assembler Rules OK",0)
  680   REM
  700   REM AND DO PASS 2
  720   REM
  740   NEXT
  800 REM
  810 REM NOW CALL THE M/C CODE ROUTINE
  820 REM
  830 CALL doit
  840 REM
  850 REM AND FINISH
  860 REM
  870 END
 9000 REM
 9010 REM FUNCTION defstring
 9020 REM ==================
 9030 REM
10000 DEF FNdefstring(string$,format%)
10010 LOCAL address%
10020 address%=P%          : REM note start address of string
10030 IF format%=0 THEN $P%=string$ ELSE IF format%=1 THEN
     $P%=string$+CHR$0 ELSE I
F format%=2 THEN $P%=CHR$(LEN(string$))+string$
     ELSE $P%=string$:P%=P%-1
10040 P%=P%+LEN(string$)+1
10050 =address%
11000 REM
11010 REM FUNCTION defbytes
11020 REM ==================
11030 REM
12000 DEF FNdefbytes(list$)
12010 LOCAL A%,B%,address%
12020 address%=P%          : REM note address of first byte
12030 A%=1
12040 B%=1
12050 REPEAT
12060   REPEAT
12070     B%=B%+1
12080     UNTIL MID$(list$,B%,1)="," OR B%>LEN(list$)
12090   ?P%=EVAL(MID$(list$,A%,B%-A%))
12100   P%=P%+1
12110   A%=B%+1
12120   UNTIL B%>=LEN(list$)
12130 =address%
```

BBC HAND RESET

Pressing the BREAK key on the BBC Computer returns the system to Mode 7, and deletes any program from memory. The message
BBC Computer
BASIC
>
appears on the screen. However, this does not reset the clock or clear the definitions of the user-defined keys. This is what the User Guide calls a 'soft reset'.

According to the User Guide a 'hard reset' (clock reset and user-defined keys reset) can be obtained in operating system version 1.0 by pressing BREAK and CTRL keys together. However, my Model B machine does not do this, neither has it anything in the hole marked 'reset' at the rear of the case.

Users with similar machines may like to know that it is possible to obtain a hard reset by pressing the BREAK key twice in quick succession. This causes the CHR$(7) 'bell' to be printed and the message
BBC Computer 32K
BASIC
>
to appear. The variable TIME will be set to 0 and the ten user-defined keys will be cleared.

Ian Simpson

TJ's WORKSHOP

NEW ATOM COMMANDS

This assembler routine enables you to create new Basic commands for your Atom. The program sets the error-handling routine pointers (in #202, #203) to the start of an assembler routine. When the new command is encountered, an error occurs and control is passed to this routine.

The routine is illustrated using a simple command ' ' which clears the screen (ie, it issues a CTRL-L). Any new Basic command(s) could be entered between lines 100 and 150.

The assembler routine is essentially in two parts. The first, lines 55 to 180, checks the error to see if it is the new command (in this case ' '); if it isn't control is passed to the usual error-handling routine. If it is the new command, the command is executed by lines 130-140 and control is passed to the second half of the routine. This part searches for the start of the next statement or line to be interpreted; when located, the statement pointers are updated by lines 260-310 and Basic execution is resumed.

John Hearn

```
 10 DIM LL(5)
 20 P.$21
 30 FOR I=1 TO 2
 40 DIMP(-1);A=P;REM Starting address=A
 50 [
 55       LDY @#1
 60 :LL0  LDA (#5),Y  #5,#6 point to statement being inerp'd
 70       CMP @#3B    #3B=;
 80       BEQ LL2
 90       CMP @#0D    #0D=return
100       BEQ LL2
110       CMP @#5E    #5E=^ (new command)
120       BNE LL1
130       LDA @#0C    Print $12, clear screen
140       JSR #FFF4   Print routine
150       JMP LL3     Return to Basic
160 :LL1  INY
170       JMP LL0
180 :LL2  JMP #C9D8   Normal error routine
190 :LL3  LDA (#5),Y  Look for next statement
200       CMP @#3B
210       BEQ LL4
220       CMP @#0D
230       BEQ LL4
240       INY         Continue search for ; or return
250       JMP LL3
260 :LL4  CLC
270       TYA         Update statement pointer in #5,#6
280       ADC #5
290       STA #5
300       BCC LL5
310       INC #6
320 :LL5  JMP #C2F2   Return to Basic
330 ]
350 N.;P.$6
360 ?#202=A%256;?#203=A/256;REM#202, #203 point to brk routine
370 ^;REM New command to clear screen
380 E.
```

BETTER RANDOMISATION

Here is a means of avoiding the prompt RANDOMIZE and its input response required by Microsoft Basic and some other Basics, while still providing fresh randomisation each time the game is run.

A sequential file is opened at the beginning of the program, from which an integer is retrieved, incremented and used as the seed before being rewritten to file. In Microsoft Basic-80 a suitable routine would be

```
10 OPEN "I",£1, "SEED"
20 INPUT £1, N
30 CLOSE £1
40 N=N+1
50 M=N
60 RANDOMIZE M
70 OPEN "O", £1, "SEED"
80 PRINT £1, N
90 CLOSE £1
. . .rest of program
```

The file "SEED" is initialised with the largest negative number that the system will support; in my case, —32767.

Theoretically, one should perhaps provide for re-initialisation when N overflows at +32768, but I doubt whether the average punter will live to see it.

If a disk contains more than one game you can incorporate this routine into the menu, so that all games share a common seeies of randomisation seeds and disk activity is reduced.

Simon Holmes

ATOM AUTO REPEAT

One of the disadvantages of the Atom keyboard is that the keys do not automatically repeat when they are held down.

This short routine replaces the normal character input routine to provide auto-repeat on all of the keys that are available to Basic programs.

The delay between the time that the key is pressed and the start of the repeat sequence is set on line 150. The number 35 gives a delay of just over half a second.

The subroutine call at line 270 causes a delay of 0.1 seconds. This could be replaced by a delay loop in order to change the repeat speed.

To use the auto-repeat routine the character input vector must be changed to point to the new routine. This can be done in Basic as follows:
?522=0; ?523=40.

This must also be done if the break key is pressed.

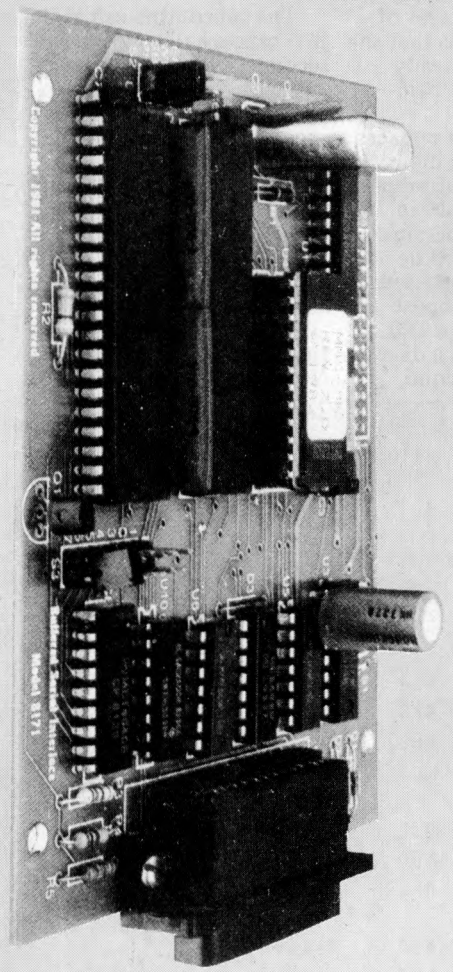
N P Capper

```
 10REM   ATOM AUTO-REPEAT ROUTINE
 20REM         BY N.P. CAPPER
 30 DIM LL(3)
 40 P.$21              ;REM turn display off
 50 F.I=0 TO 1         ;REM do two passes
 60 P=#2800            ;REM store at #2800
 70[
 80:LL0  PHP           save flag reg
 90      CLD           set binary mode
100      STX #E4       save x
110      STY #E5       save y
120      JSR #FE71     scan keyboard
130      BCC LL2       key pressed
140
150:LL1  LDX @35       put repeat delay
160      STX #80       into #80 and get
170      JMP #FEA4     ascii code
180
190:LL2  DEC #80       delay loop
200      BEQ LL3
210      JSR #FE66     wait 1/60 sec
220      JSR #FE71     scan keyboard
230      BCS LL1       key released
240      BCC LL2       key still pressed
250
260:LL3  INC #80       set delay to 1
270      JSR #FB8A     wait 1/10 sec
280      JMP #FEB1     get ascii code
290
300]
310 N.                ;REM do next pass
320 P.$6              ;REM turn display on
330 END
```

WARNING!

In last month's TJ's we published a method to speed up the display on the PET ('Faster PET Screen', page 174). We have since been advised that on certain models this can cause serious damage to the video circuitry. Unfortunately there is no easy way to tell whether your PET is one of these models other than by trying the POKEs mentioned and switching off *immediately* if the screen display collapses. To be safe, we advise readers *not* to use this method of speeding up the display.

HOW TO USE YOUR EPSON WITHOUT WASTING COMPUTER TIME



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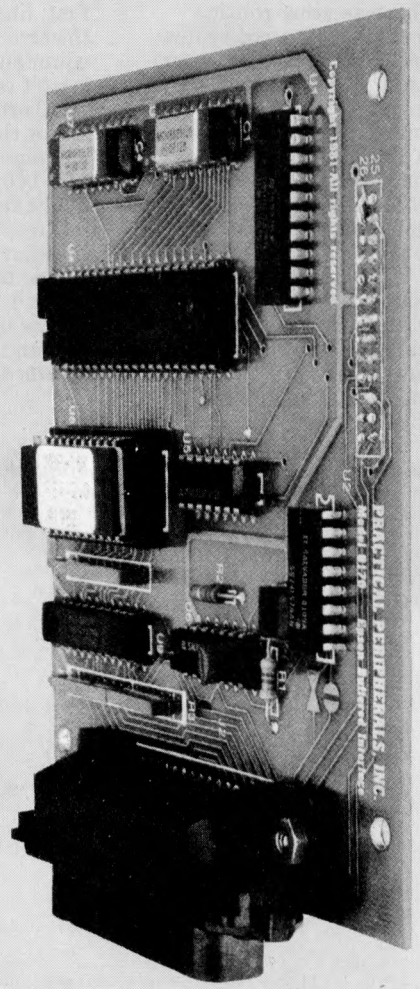

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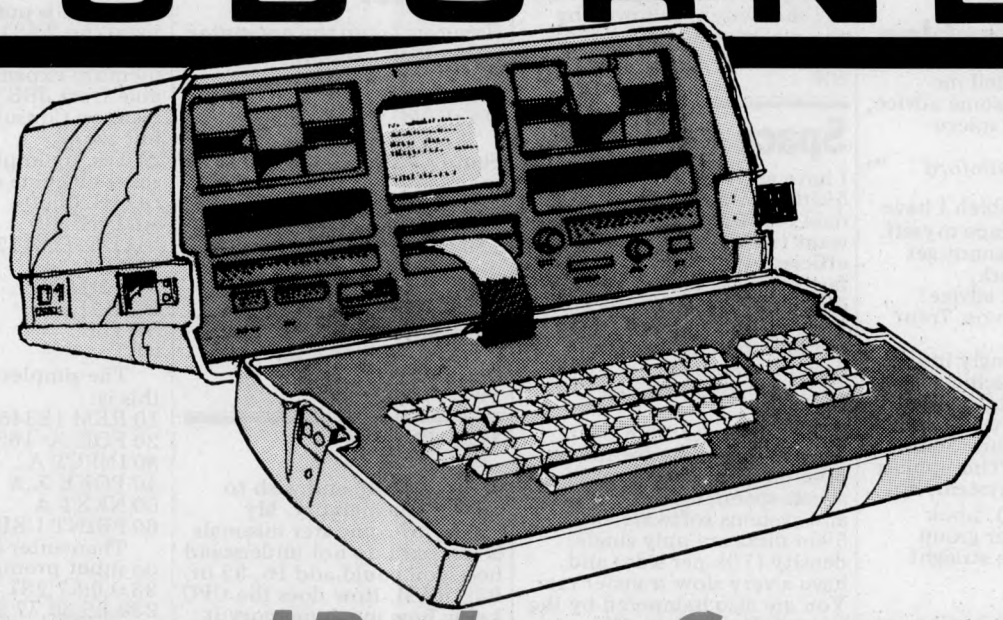

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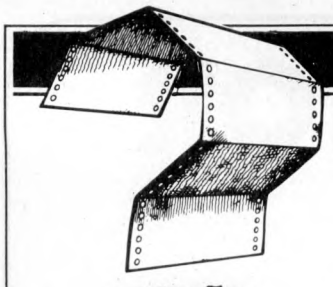


COMPUTER ANSWERS

Send your queries to: Sheridan Williams, 35 St Julian's Road, St Albans, Herts. Please note that Sheridan can no longer answer questions on an individual basis, so please don't send an SAE with your query.

TRS-80 troubles

Could you please tell me where I could get some advice about my TRS-80 microcomputer?
Martin Pearce, Castleford

I own a TRS-80 which I have attempted to upgrade myself. Unfortunately I cannot get the upgrade to work, so where can I get advice?
J Harrison, Burton-on-Trent

I believe very strongly in self-help. This can be achieved by joining a local club, or user group. There you will find others who have surmounted similar problems. This applies to any computer system, not just to the TRS-80. Look through *PCW*'s user group index and join one straight away.
SW

VIC follow-up

The following letter from I Wright of Sheffield refers to the query 'VIC Interface' in the June issue of *PCW*. The original question was: 'Here in Athens the VIC cassette is £90 — is there a way of using an ordinary cassette recorder on the VIC?'

Mr Wright has the following advice:

The solution is a single pole, single throw switch used to ground the 'switch' connection on the cassette output port. Precise details are:
1) Ignore the 5V and 9V lines on the output port.
2) Connect the 'data out' and 'data in' lines to the centre conductors of two lengths of microphone cable, the screens of which go to the 'ground' (0V) line.
3) Connect the other ends of these to 3.5mm jack plugs as normal and insert these into the mic and earphone sockets of the recorder (beware of DIN sockets as there are often unwanted resistors lurking behind these). Remember that the IN and OUT designations of these lines refer to the computer and *not* the recorder.
4) Finally, wire a switch between the 'switch' line and 'ground'. If you're not unduly worried about guarantees, etc, the best place to secure this is probably the main computer case.

To operate, type SAVE"" and press RETURN as normal. The VIC will reply with 'PRESS RECORD AND PLAY BUTTONS'; turn on the tape recorder, wait for the leader to pass, then turn on the 'magic switch' and the program will be saved as normal. When complete, turn off the switch, followed by the recorder. Loading is just as simple.
SW

Space problem

I have an RML 380Z with 5¼in disks and want to store data on 10,000 stock items. I want to know the most efficient (least storage), fastest access method of doing this. I need to be able to access any item by part number, description or drawing number.
J F Cain, Redhill, Surrey

The 380Z is far from being the ideal machine for the purpose on three counts: disk access speed, disk capacity and systems software. The 5¼in disks are only single density (70k per side) and have a very slow transfer rate. You are also hampered by the lack of direct access file handling capability in RML Basic, though you can obtain this from a company called Software Production Associates. I suggest that you use Cobol as this supports index sequential files. You will have to code your data substantially as with 10,000 items each needs only to be seven characters in length and your 70k is gone. In fact you will certainly need to split the file across several disks and sides.

You really need a system with large-capacity disks — 8in or even a hard disk.
SW

Musical micro

I have heard that there is available a micro that can not only play a tune but can also print out the music onto manuscript paper. Can you please tell me more about it?
A P Hawkins, Camberley, Surrey

The system you have heard about might well be the Apple II computer fitted with an Alf Products MC16 or MC1 Music Synthesizer board. This provides facilities for composing music on the screen and displaying it in full musical notation. The resultant music can then be played through the user's external audio system. By using a high-resolution graphics printer like the Epson MX100 it should also be possible to print out the music score, screen by screen. Details of the Alf synthesisier boards are in *PCW* vol 4, number 5, May 1981.
P L McIlmoyle

Stop it!

How can I stop the computer responding to control characters when using Basic's INPUT$(1) command?
D Salkeld, Weymouth

Simply test after the input — for example:

```
100 CH$=INPUT$(1):
      CH=ASC(CH$)
110 IF CH<32 OR CH>122
      THEN 100
120 PRINT CH$;
```

Using this technique you can restrict the input to only the numeric keys, for instance.
SW

'81 RAM

I own a ZX81 and wish to extend the memory. My theory of computer internals is low, so I do not understand how you could add 16, 32 or 64k RAM. How does the CPU know how much memory it has?

Also, can you recommend Audio Computers of Southend and its 32k RAM pack?

Finally, how easy would it be to assemble from kit?
David Pye

The Z80 is capable of directly addressing up to 64k RAM. So if you subtract 8k for the Sinclair ROM, then the ZX81 is capable of having 56k RAM.

The simplest way for the Z80 to check how much memory it has is by loading each location with 02 (or any other number) and then reading them back — if the result is 02 then there is RAM there; if the answer is 00 then there isn't.

The Audio Computers RAM pack looks very good value. I myself tried to obtain one a few months ago. After sending the money I was repeatedly told that it would arrive within the week. After two months I gave up and asked for my money back, which I got.

If you decide to build any kit involving ICs, it's important to have a good fine soldering iron, which isn't too powerful, and some experience of soldering.
James Walsh

I should be grateful for your answers on three ZX81 questions:
1) Is there a larger RAM than 16k?
2) Is it possible to determine what portion of memory space remains at any stage of program development?
3) Is there any programmable way of deleting 50 or 60 program instructions?
C Payne

Starting with the first question first:
1) Yes, it is possible to expand the ZX81 up to 56k RAM. These types of memory expansion are available from JRS Software and Hewson Consultants, to name but two.
2) Yes, by implementing this short machine code routine:

```
LD HL,0000
ADD HL,SP
LD DE,(16412)
AND A
SBC HL,DE
LD B,H
LD C,L
RET
```

The simplest way of doing this is:

```
10 REM 123456789012
20 FOR X=16514 TO 16526
30 INPUT A
40 POKE X,A
50 NEXT A
60 PRINT USR 16514
```

Then enter these numbers on input prompt:
33,0,0,57,237,91,28,64,107, 238,66,68,77,201.

You can now delete lines 20-60.

Any time you want to know the remaining memory, just type PRINT USR 16514.
3) Again the answer is yes. This function is available on the Picturesque ScreenKit.
James Walsh

I own a ZX81 and have read many adverts on books to explain how to use the ZX81 'monitor'. What is the monitor and what can I do with it?

Also, I am on my seventh 16k RAM Pack and it works all the time but now and then when I press SHIFT plus another character the memory wipes itself. I have sent away so many times to Sinclair and waited so long that I don't know whether to send away for a replacement or my money back.
John Hogg

The monitor is a set of routines within the ZX81 ROM which deals with the operations which the CPU cannot handle on its own. For example, printing on the screen and expanding the display file at the same time and doing the mathematical functions. The best way to find out about the monitor and what you can do with it is to read Ian Logan's book

Understanding Your ZX81 ROM.

If I had as much trouble with my Sinclair RAM Pack then I would be inclined to ask for a refund and buy one of the independently manufactured RAM Packs which are on the market. These

don't suffer from most of the problems of the Sinclair model.
James Walsh

I have recently bought one of the machine code programming books advised in the ZX81 Basic Manual. The book doesn't tell you how to get into machine code but just what to do when you are there. I've tried USR routines but they don't seem to work, it's probably that I am doing something wrong. Please can you help?
Jonathan Menmuir
The simplest way of entering machine code on the ZX81 is to put a large REM statement as the first line of the program, and POKE the decimal value of the desired instruction into address 16514 onwards. For example:

```
10 REM 1234567890
20 LET X=16514
30 INPUT A
40 IF A=999 THEN STOP
50 POKE X, A
60 PRINT A; " ";
70 GOTO 20
```

The REM statement must be able to hold the same number of characters as your machine code routine is long. If you type '999' (there is no such m/c instruction) then the program will stop, so that you can execute your routine. To execute type RAND USR 16514.
James Walsh

The sole of a new machine

I read your Benchtest of the ZX Spectrum and am very interested to see such a cheap and efficient personal computer.

Would you tell me if the Spectrum would serve me in the following area: I sell shoes in a large boutique and want to check my stocks, thus enabling me to serve customers faster. I keep 40 types of shoe in each of four colours and five sizes. I sell 15 pairs a day and serve about 20 customers.
Mehmet Muderrisoglu, Istanbul

You should remember that computers need to be fed with information in order to be kept up to date. This will entail entering the transactions as they take place, or in batches at the end of the day, say. If your requirement is really as simple as you state, then the Spectrum would cope, because you could code the model, colour and size as single characters; this would need only around 800 bytes of data storage. This could be loaded from cassette at the start of the day and dumped out at the end (barring power failures, etc). My advice would be to go for a system with a proper keyboard which also has good dealer backup in Istanbul. Once you require the system to handle accounts, sales statistics, etc, you should certainly look for a more up-market business system.
SW

Newbrain v Spectrum

I am considering a computer in the £200 range for some medical and financial applications. So far I have narrowed the choice down to the Newbrain Model A and the Sinclair Spectrum (48k).

The Newbrain offers greater memory expansion (to 512k), higher resolution graphics with an 80-column display option (for word processing) and interfaces which would allow disks and CP/M to be used. The Spectrum offers colour and sound and the likelihood of cheaper disks but seems to have limited expansion potential. How would you compare these for my application? Also, how does the Newbrain ANSI compare with the Sinclair Basic?
A Wetter, London N1

As with so many questions it is, as you imply, very much a matter of selecting the right machine for your particular application, rather than one being 'better' than another in some general way. In your case the Newbrain seems to me to have a number of attractions.

Firstly, it is generally about twice as fast as the ZX Spectrum in most benchmarks. Assuming that your medical work calls for searching databases of some type, this could be quite significant. Secondly, the Newbrain has what is essentially a standard typewriter keyboard. If you, or anyone entering data on your behalf, can touch-type, this is a very great advantage over the Spectrum, which does not have such a good keyboard. If you are a novice programmer the Spectrum's multi-function keys can be a great help, but with more experience they can become rather frustrating (which is only to say that the Spectrum is just right for its intended market!).

Again, if you want to use commonly available professional software, the ability of the Newbrain to support standard size disk drives and to run the 'industry standard' CP/M operating system is of great advantage.

On the other hand, the Spectrum offers a cheaper route to a system complete with disk drives and a printer (once the special micro floppy drives become available) and does provide colour graphics, if that is significant for your applications. Doubtless somebody will put CP/M onto the Spectrum soon, too!

As regards the two versions of Basic, both strike me as being above average. The I/O handling on the Newbrain is a little complex, but very powerful, while the Sinclair Basic offers a much better method of handling sub-strings than does the more usual Microsoft Basic.
P L McIlmoyle

Mono Dragon

In the August issue of *PCW* Mike Curtis reviewed the Dragon 32, saying that the computer plugs into the back of a colour television. I only have black and white, so will I be able to use the Dragon?
T Caddies, Newcastle-on-Tyne

Any colour computer that sends out a colour signal can be used on a b&w set. However, you will have difficulties seeing some of the colours: light blue, for instance, can often only be seen on a b&w set if the brightness is turned right up.
SW

X-ray vision

I have a question for my own 'Answers' page. I hope some readers may be able to answer it.

Colour TV sets give off X-rays. It has been assumed that this causes no problems when watching at home because of the usual viewing distance from the set. However, it worries me to think that I am being saturated by X-rays when using the colour TV attached to a computer, because I sit less than one metre from the screen. I have no desire to die of these effects on *PCW*'s behalf, so could someone reassure me and readers that the effect is not worth worrying about?
Sheridan Williams

There are in fact at least two ways to overcome this problem. The first is to make use of the ability to program the numeric pad keys to generate the ASCII code for DEL (127 decimal).

Alternatively, and much simpler, pressing Control together with the minus sign key will generate DEL.
P L McIlmoyle

Which monitor?

I am interested in the Microvitec LCCD colour monitor and intend to use it with my BBC Computer. I notice that it has a bandwidth of 7 MHz and a resolution of 452(H) by 585(V) elements. Can it be used with 80-column text?
W H Kwan, Durham

We have reviewed b&w and colour TVs and monitors in the June issue of the Beebug magazine. It was apparent that no colour set (not even RGB) gave a picture quality on 80 columns that was comfortable to read for long periods.

The Microvitec is available in three models — Standard, 1V Linear and high resolution. The bandwidths are 6, 7 and 12 MHz respectively and the horizontal resolutions are 452, 452 and 895 elements respectively. They all have the same (585 elements) vertically. For serious word processing use it is essential to use a black and white *monitor* and even the cheapest of these seem adequate. Prices of the three Microvitec sets (14in) are £274, £295 and £499 respectively. For more details write to Microvitec Ltd, PO Box 188, Futures Way, Bradford, BD4 7TU (tel 0274 390011).
SW

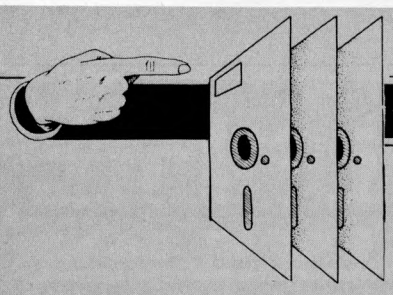
Osborne rub-out

I have recently started to use an Osborne 1 and am generally impressed by it. The keyboard is not as solid-feeling as I would like, but must obviously be light for portability. However, there is one curious and awkward omission, which is the lack of a DEL (or RUBout) key. This is particularly frustrating when using Wordstar, as deleting the character just typed then needs Control-S to backspace, followed by Control-G to delete the character the cursor is then on, rather than just pressing DEL. Is there any way to provide a DEL function on this machine?
(Name and address withheld by request)

C sought

I wish to download software I have developed on the Onyx C8002 to a Superbrain for testing under CP/M. I am a little unsure of how to write the driver software in C to handle the communication between the two machines' IEEE ports. I would be grateful if you could recommend any books I could read to help me solve the problem.
H Frost, Shepperton, Middx

For the C language used for the driver program I would recommend *C Programming Language* by Brian Kernighan and Dennis Ritchie, obtainable from Lifeboat Associates, PO Box 105, London WC2H 9LU. One of the best books on CP/M that I know is the *CP/M User's Guide*, published by McGraw-Hill/Osborne. *The CP/M Handbook* by Rodnay Zaks (published by Sybex) is also excellent, although it does not go into the inner workings of CP/M to the same extent. The Digital Research CP/M handbooks are also essential for your project, but I expect you are familiar with these.
P L McIlmoyle



PACKAGES

PCW's 'Packages' section is produced bi-monthly, alternating with our 'In Store' hardware guide. We have confined coverage to business packages which are available and supported at national level and which have been in use for at least six months in a minimum of five sites. Producers of packages which fall within these constraints should send details or updates to: **Dick Olney,** *PCW,* **14 Rathbone Place, London W1P 1DE.**

The layout has been designed to allow you to discover which packages are available for the application you have in mind and to show you which packages are available for your computer if you already have a machine. In either case the code enables you to look up the supplier's name and telephone number in the table below.
All details published are the latest made available — some may have changed since this issue went to press.

Code	Company	Telephone
A1	ACT/Petsoft	021-454 8585
A2	Arden Data Processing	0533 22255
A3	ADP Network services	01 388 1912
A4	Alamo Comp. Serv.	0642-310381
B1	B + B Computer Ltd.	0204 26644
B2	Beam Business Centre	061-831-7292
B3	Benchmark Computer Systems	0726 61000
B4	Bristol Software Factory	0272 23430
B5	Byte Soft Systems Ltd	0533 531441
B6	Business Solutions Ltd	01-554-5985
B7	Bromley Computer Consultancy	01 464 8080
C1	CAP-CPP Products Ltd.	01-404 0911
C2	Commodore	01-388 5702
C3	Compsoft	0483 39665
C4	Comput-a-crop	0507-604271
C5	Computastore Ltd.	061-832-4761
C6	Computech	01-794 0202
C7	Compass	Standish 426252
C8	CWP Computers	01-828 3127
C9	C4 Computer Services	0632-664313
C10	Caxton Software	01 379 6502
C11	CBS Consultants	021-722-8181
C12	Comp Prog & Systems Serv	0942-38831
E1	Engineering Sciences	01-437-4894
G1	Graffcom Systems Ltd.	01-727 5561
G2	Grama (Winter) Ltd.	01-636 8210
G3	Great Northern	0532 589980
G4	Alan Greenhalgh Ltd	01-520-0218
G5	Grade One	Glossop 63819
H1	A.J. Harding	0424 220391
H2	Hartford Software	0606 76265
H3	H.B. Computers	0536 83922
H4	Wordcraft Systems	0332 760127
I1	Intereurope Software Design	0734 786644
I2	Intex Datalog Ltd	0642 781193
J1	T.V. Johnson	0276 20446
K2	Keen Computers	0602 412777
L1	Lifeboat Associates	01-836 9028
L2	Liveport (Exidy Sorcerer Firmware)	0736 798157
L3	Ludhouse (Computing) Ltd.	01-679 4321
L4	Logic Comp Systems	01-222-1122
M1	Micro Computer Applications Ltd.	0734 470425
M2	Microteck.	Orpington 26803
M3	Microsys Ltd	051 426 7271
M4	Microsave	0272 737555
M5	M.A.P. Comp Systems	061-624-5662
P1	Padmede Computer Services	02514 21892
P2	Personal Computers Ltd.	01-377 1200
P3	Professional Computer Services	061 624 4065
Q1	Quill Computer Systems.	061 477 4960
R1	Rockliff	051-521 5830
S1	SMG Micro Computers	0474 55813
S2	The Softwarehouse	01-637 2108
S3	Stage One Software	0202 735656
S4	Systematics International	0440 61121
S5	Sumlock Bondain	01-250 0505
S6	Stemmos	01 602 6242
S7	Software Aids Int	01-904 8139
T1	Tridata Micros Ltd.	021 622 6085
T2	Templeman Software	0789 66237
T3	The Micro Solution	0608 3256
T4	Terodec Ltd	0734-664343
T5	TABS Ltd	0264-58933
T6	Tip Data Ltd	0375-33910
V1	Vlasak Electronics Ltd.	0494-448633
W1	Wisbech Computer Services	0945 64146
W2	Westfarthing Comp Services	03265-4098
X1	Xetal	061 682 7555

Applications

Appointments	Act Sirius 1	£115	C7
planner	Challenger	£25	C7
Assembler dev	PET/CBM	£50	L2
Bill of materials	Apple II	£199	T5
	CP/M	£850	B5
	CP/M	£199	T5
	Cromemco	£850	B5
	PET/CBM	£199	T5
	Superbrain	£450	T3
Bookmakers package	CP/M	POR	B7
Budgeting package	Apple II	£125	P2
	Apple II	£125	T2
	CP/M	£95	B5
	Cromemco	£95	B5
	North Star Horizon	£95	B5
Bureau de change	PET/CBM	£8	H3
Cash flow	Apple II	£125	P2
	Apple II	£80	V1
	Apple II	£100	C8
	CP/M	£250	L3
	CP/M	£95	B5
	Cromemco	£95	B5
	North Star Horizon	£95	B5
	PET/CBM	£8	A1
Cash register	CP/M	£300	T4
Cheque writer	CBM/8032	£90	P3
	PET/CBM	£90	P3
Company secretary	CP/M	£450	C4
Container accounting	CP/M	£750	M5
Contract costing	Apple II	£500	P1
	CP/M	£2000	L3
CP/M & utilities	Tandy Model II	£150	M1
Credit control	Apple II	£98	P2
	PET/CBM	£650	B4
Customer file	Famos	£1000	M2
Database management/Information retrieval	ACT800	£225	H4
	Apple II	£150	A2
	Apple II	£150	K2
	Apple II	£60-140	S2
	Apple II	£150	S5
	Apple II	£75	P2
	Apple II	£100	S4
	Apple II	£100	C8
	Apple II	£125	T2
	CP/M	£150-750	C4
	CP/M	£100	G3
	CP/M	£350	B3
	CP/M	£400	C3
	CP/M	£600	G5
	Famos	£1500	M2
	North Star Horizon	£250	B3
	PET/CBM	£250	C3
	PET/CBM	£325	A1
	PET/CBM	£225	H4
	PET/CBM	£75	B1
	PET/CBM	£50/150	C2
	PET/CBM	£150	J1
	PET/CBM	£150	G2
	Superbrain	£300	S6
	Tandy Model 1	£25-80	M1
	Tandy Model 1	£60	S2
	Tandy Model 1	£150	J1
	Tandy Model 1	£32.50	H1
	Tandy Model 111	£270	A4
	8000 Series	POR	C2
Dental Records	Apple II	£395	M4
	CP/M	£500	T4
Disk operating system	PET/CBM	£150	B1
Double glazing costing	North Star Horizon	£750	W1
Eire payroll system	CP/M	£650	M5
Estate agent	Apple II	£850	A2
	Apple II	£850	S5
	Apple II	£850	K2
	Apple II	£175	P2
	Apple II	£130	C8
	Apple II	£750	S4
	PET/CBM	£30	H3
	CP/M	£750	C4
	CP/M	£700	B5
	PCC 2000 Simpelec Triton 3	£350	B3
	MZ-80K	£195	W1
	PET/CBM	£25	A1
	Superbrain	£600	S6
	Superbrain	£600	C12
Equipment lease/rent/HP	CP/M	£400	G1
File Handling	PET/CBM	£225	H4
Financial modelling	Act Sirius 1	£595	A1
Apple II	£450	P2	
	Apple II	£424-535	A1
	Apple II	£360	C8
	CP/M	£400	G1
	CP/M	£95	B5
	CP/M	£425-535	A1
	CP/M	£400	B6
	Cromemco	£95	B5
	North Star Horizon	£95	B5
	PET/CBM	£425-535	A1
	RAIR Black Box	POR	A3
Financial planning	Act Sirius 1	£150	A1
	Apple II	£250	S4
	Apple II	£125	A1
	CP/M	£125	A1
	PET/CBM	£125	A1
General ledger/NL	Apple II	£300	A2
	Apple II	£300	S5
	Apple II	£300	K2
	Apple II	£455	P2
	Apple II	£225	V1
	Apple II	£295	C6
	Apple II	£250P	S4
	Apple II	£600	T2
	Apple II	£490	L4
	Apple II	£199	T5
	CBM/8032	£450	C11
	CP/M	£500	L3
	CP/M	£375	L1
	CP/M	£500	C4
	CP/M	£400	G1
	CP/M	£400	M3
	CP/M	£400	B5
	CP/M	£275	S6
	CP/M	£275	S7
	CP/M	£350	B3
	CP/M	£300	W1
	CP/M	£425	B6
	CP/M	£500	T4
	CP/M	£400	M5
	CP/M	POR	B7
	CP/M	£199	T5
	Cromemco	£400	B5
	North Star Horizon	£250	B3
	North Star Horizon PCC 2000	£400	M3
	North Star Horion PCC 2000	£400	B5
	Simpelec Triton 3	£350	B2
	PET/CBM	£200	C2
	PET/CBM	£200	H3
	PET/CBM	£199	T5
	Sharp PC3201	£450	P2
	Superbrain	£400	M3
	Superbrain	£400	S6
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	Tandy Model 1	£225	H1
	Tandy Model 1	£225/325	T1
	Tandy Model 11	£425	T1
	Vector	£400	C5
	8080/Z80	£357	L1
	8080/Z80	£275	G3
General purchase transaction proc.	CBM/8032	£495	S3
Hotel management	Apple II	£525	M4
	CP/M	£525	M4
	RAIR Black Box	POR	A3
Incomplete records	Act Sirius 1	£1200	S1
	Apple II	£250	S2
	Apple II	POR	K2
	Apple II	£425	P2
	Apple II	£450	P1
	Apple II	£490	L4
	CP/M	£750	M3
	CP/M	£250	B5
	CP/M	£975	B3
	CP/M	£750	W1
	CP/M	£1250	M5
	Cromemco	£250	B5
	North Star Horizon	£750	M3
	North Star Horizon	£250	B5
	North Star Horizon	£975	B3
	Superbrain	£750	M3
	Superbrain	£1200	S1
	Tandy Model 1	£40	M1
	Tandy Model 1	£40	H1
Industrial cleaning package	CP/M	POR	B7
Industry Factory loading	Apple II	£360	X1
	CP/M	£360	X1
	PET/CBM	£300	X1
Industry work study	Apple II	£990	X1
	CP/M	£990	X1
	PET/CBM	£750	X1
Inn Management	Act Sirius 1	£185	C7
Insurance Broker	Act Sirius 1	£450	C7
Insurance renewals	CBM/8032	£1200	S3
Integrated accts	Act Sirius 1	£495	A1
	Altos (CP/M, MP/M)	£300	B1
	Apple II	£450	P1
	Apple II	£300	P2
	Apple II	£855	V1
	Apple II	£600	T2
	Apple II	£1470	L4
	Apple II	£300	W2
	Apple II	£199	T5
	CBM/8032	£1500	P3
	CBM/8032	900	C11
	CP/M	£950	L1
	CP/M	£1500	C4
	CP/M	£1100	G1
	CP/M	£990	M3
	CP/M	£690	B5
	CP/M	£850	S7
	CP/M	£900	B5
	CP/M	£1450	B3
	CP/M	£1200	B6
	CP/M	£199	T5
	Cromemco	£690	B5
	Cromemco	£900	B5
	Famos	£2000	M2
	MZ-80K	£150	P2
	North Star Horizon	£950	B3

PACKAGES

	North Star Horizon	£690	B5
	North Star Horizon	£900	B5
	PET/CBM	£300	B1
	PET/CBM	£800	S3
	PET/CBM	£199	T5
	North Star Horizon	£990	M3
	PET/CBM	(£50)	C2
	PET/CBM	£650	J1
	PET/CBM	£650	G2
	Superbrain	£990	M3
	Superbrain	£1200	S6
	Superbrain	£1000	T3
	Superbrain	£1200	S1
	Tandy Model I	£350	M1
	Tandy Model II	£350	M1
	Tandy Model I	£75	J1
	Tandy Model III	£550	A4
	Vector	£1000	C5
	8000 Series	POR	C2
	8080/Z80	£950	L1
	8080/Z80	£995	G3
Investment portfolio	Tandy Model I	£20	S2
Invoicing	Act Sirius 1	£95	C7
	Apple II	£295	S2
	Apple II	£300	P1
	Apple II	£300	P2
	Apple II	£140	V1
	Apple II	£300	T2
	Apple II	£199	T5
	Challenger	£25	C7
	CP/M	£325	L1
	CP/M	£150-350	C4
	CP/M	£250	M3
	CP/M	£150	S7
	CP/M	£100	B5
	CP/M	£200	B3
	CP/M	£300	W1
	CP/M	POR	B7
	CP/M	£199	T5
	Cromemco	£100	B5
	North Star Horizon	£100	B3
	North Star Horizon	£250	M3
	North Star Horizon	£100	B5
	PET/CBM	£350	A1
	PET/CBM	£25-50	B1
	PET/CBM	POR	J1
	PET/CBM	£199	T5
	Superbrain	£250	M3
	Superbrain	£150	S6
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	Tandy Model I	£25	H1
	Tandy Model I	£75	T1
	Tandy Model II	£125	T1
	Tandy Model III	£280	A4
	8080/Z80	£325	L1
Job costing	Act Sirius 1	£350	C7
	Apple II	£300	P1
	Apple II	£990	X1
	Apple II	£199	T5
	CBM/8032	£1000	C11
	CP/M	£700	C4
	CP/M	£350	M3
	CP/M	£990	X1
	CP/M	£500	T4
	CP/M	£650	M5
	CP/M	POR	B7
	CP/M	£199	T5
	CP/M	£1500	T6
	North Star Horizon	£350	M3
	PET/CBM	£750	X1
	PET/CBM	£199	T5
	Superbrain	£350	M3
	Tandy Model I	POR	M1
	Tandy Model II	POR	M1
Job order control	8080/Z80	£275	G3
Legal precedents	CP/M	£1100	C4
Letter writer	Apple II	£80	V1
	Apple II	£99	T5
	CP/M	£150	M3
	CP/M	£99	T5
	North Star Horizon	£150	M3
	Superbrain	£150	M3
Local government housing maint	RAIR Black Box	POR	A3
Lotteries	PET/CBM	£45	H2
Mailing List	Altos (CP/M. MP/M)	£75	B1
	Apple II	£300	A2
	Apple II	£50-150	S2
	Apple II	£300	S5
	Apple II	£300	K2
	Apple II	£40	P2
	Apple II	£100	S4
	CP/M	£50-150	C4
	CP/M	£250	G1
	North Star Horizon	£195	W1
	PET/CBM	£45	H2
	PET/CBM	£15	A1
	PET/CBM	£75	B1
	PET/CBM	£35	H3
	Superbrain	£140	C9
	Tandy Model 1	£40	M1
	Tandy Model II	£75	M1
	Tandy Model I	£50-150	S2
	Tandy Model I	£25/38/55	H1
Mail shot	Apple II	£14	S2
	Apple II	£40	P2
	Apple II	£25	T2
	Apple II	£99	T5
	Challenger	£25	C7
	CP/M	£200-360	C4
	CP/M	£90	M3
	CP/M	£75	S7
	CP/M	£50/150	G5
	CP/M	£99	T5
	MCZ Zilog	£250	I1
	North Star Horizon	£90	M3
	PCC 2000 Simplec Triton 3	£450	B2
	Superbrain	£90	M3
	Tandy Model I	£75+	G4
	Tandy Model II	£75	M1
	Tandy Model II	£75+	G4
	Tandy Model III	£160	A4
Membership accting	Apple II	£75	P2
	MCZ Zilog	£250	I1
	PET/CBM	£85	H2
Motor Dealer	Act Sirius I	£345	C7
	CBM/8032	£950+	P3
	Famos	£5000	M2
Order entry/invoicing	Apple II	£99	T5
	CBM/8023	£750	P3
	CP/M	£350	G1
	CP/M	£500	T4
	CP/M	£550	M5
	CP/M	£550	L1
	CP/M	POR	B7
	CP/M	£99	T5
	8080/Z80	£550	L1
Order Processing	AppleII	£99	T5
	CP/M	£99	T5
Office admin	Apple II	£100	S4
Pad to plotter systems	Apple II	£250	P2
	Apple II	£180	C8
Payroll	Apple Ii	POR	A2
	Apple II	£200	S2
	Apple II	POR	S5
	Apple II	POR	K2
	Apple II	£200	P2
	Apple II	£375	V1
	Apple II	£375	C6
	Apple II	£250P	S4
	Apple II	£400	T2
	Apple II	£490	L4
	Apple II	£199	T5
	CBM/8032	£375	P3
	Challenger	£24	C7
	CP/M	£450	L3
	CP/M	£475	L1
	CP/M	£495	C4
	CP/M	£500	G1
	CP/M	£390	M3
	CP/M	£500	B5
	CP/M	£450	B3
	CP/M	£425	B6
	CP/M	Lease	W1
	CP/M	£500	T4
	CP/M	£450	M5
	CP/M	POR	B7
	CP/M	£199	T5
	Famos	£1500	M2
	North Star Horizon	£350	B3
	North Star Horizon	£390	M3
	North Star Horizon	Lease	W1
	PET/CBM	£200/350	C5
	PET/CBM	£200/25/195	A1
	PET/CBM	£50/195	I2
	PET/CBM	£150	G2
	PET/CBM	£150	J1
	PET/CBM	£150	C2
	PET/CBM	£10	H3
	PET/CBM	£199	T5
	Scorcerer	£250	L2
	Superbrain	£390	M3
	Superbrain	£400	S6
	Superbrain	£250+	T3
	Tandy Model 1	£249	M1
	Tandy Model I	£200	H1
	Tandy Model I	£218	T1
	Tandy Model II	£375	T1
	8000 Series	£250	C2
	8080/Z80	£475	L1
	8080/Z80	£275	G3
	PET/CBM	£150	G2
	PET/CBM	£150	J1
	PET/CBM	£150	C2
	Sorcerer	£250	L2
	Tandy Model I	£249	M1
	TRS-80	£200	H1
	TRS-80I	£218	K1
	TRS-80I	£218	T1
	TRS-80II	£375	T1
	8000 Series	£250	C2
	8080/Z80	£475	L1
	8080/Z80	£275	G3
Perpetual Inventory	CP/M	£150	B5
	Cromemco	£150	B5
Personnel records	Apple II	£98	P2
	CP/M	£450	C4
	MCZ Zilog	£400	I1
	PET/CBM	£85	H2
Petaid report generator	PET/CBM	£250	S3
Petsoft programs	PET/CBM	£160	J1
Postal advertising response package	Apple II	£350	S2
Price lister	PET/CBM	£12	H3
Product Management	Act Sirius I	£245	C7
Production analysis	Apple II	£75	P2
	CP/M	£700	C4
	PET/CBM	£300	B1
Production control	CBM/8032	£650+	P3
	PET/CBM	£650+	P3
Prof appts groups	8080/Z80	£275	G3
Prof appts individ	8080/Z80	£220	G3
Prof client billing	8080/Z80	£330	G3
Programming aids	Apple II	£40	P2
Property management	CP/M	£450-1000	C4
	CP/M	£400	M3
	CP/M	POR	B7
	North Star Horizon	£400	M3
	Superbrain	£400	M3
Purchase ledger	Apple II	£300	A2
	Apple II	£300	S5
	Apple II	£300	K2
	Apple II	£295	C6
	Apple II	£300	P1
	Apple II	£300	P2
	Apple II	£315	V1
	Apple II	£250P	S4
	Apple II	£300	T2
	Apple II	£490	L4
	Apple II	£199	T5
	Challenger	£25	C7
	CBM/8032	£500	C11
	CP/M	£500	C4
	CP/M	£450	G1
	CP/M	£500	L3
	CP/M	£425	L1
	CP/M	£400	M3
	CP/M	£400	B5
	CP/M	£275	S7
	CP/M	350	B3
	CP/M	£300	W1
	CP/M	£425	B6
	CP/M	£500	T4
	CP/M	£400	M5
	CP/M	POR	B7
	CP/M	£199	T5
	Cromemco	£400	B5
	North Star Horizon	£250	B3
	North Star Horizon	£400	M3
	North Star Horizon	£400	B5
	Superbrain	£400	M3
	Superbrain	£300	S6
	PCC 2000 Simpelec Triton 3	£350	B2
	PET/CBM	£300	B4
	PET/CBM	£95/120/350	A1
	PET/CBM	£200	C2
	PET/CBM	POR	J1
	PET/CBM	£350	H3
	PET/CBM	£199	T5
	Sharp PC3201	£300	P2
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	Tandy Model I	£225	H1
	Tandy Model I	£225	T1
	Tandy Model II	£375	T1
	Vector	£400	C5
	8000 Series	£250	C2
	8080/Z80	£275	G3
	8080/Z80	£425	L1
Quotation estimating	Act Sirius I	£125	C7
	Apple II	£300	P1
Recruitment Agency	Act Sirius I	£345	C7
Resource optimiser	Apple II	£295	C10
Sales ledger	Apple II	£300	A2
	Apple II	£300	S5
	Apple II	£300	K2
	Apple II	£295	C6
	Apple II	£300	P1
	Apple II	£300	P2
	Apple II	£315	V1
	Apple II	£250P	S4
	Apple II	£300	T2
	Apple II	£490	L4
	Apple II	£199	T5
CBM/8032	£500	C11	
	Challenger	£25	C7
	CP/M	£500	C4
	CP/M	£450	G1
	CP/M	£500	L3
	CP/M	£425	L1
	CP/M	£400	M3
	CP/M	£400	B5
	CP/M	£275	S7
	CP/M	£350	B3
	CP/M	£300	W1
	CP/M	£425	B6
	CP/M	£500	T4
	CP/M	£400	M5
	CP/M	POR	B7
	CP/M	£199	T5
	Cromemco	£400	B5
	North Star Horizon	£250	B3
	North Star Horizon	£400	M3
	North Star Horizon	£400	B5

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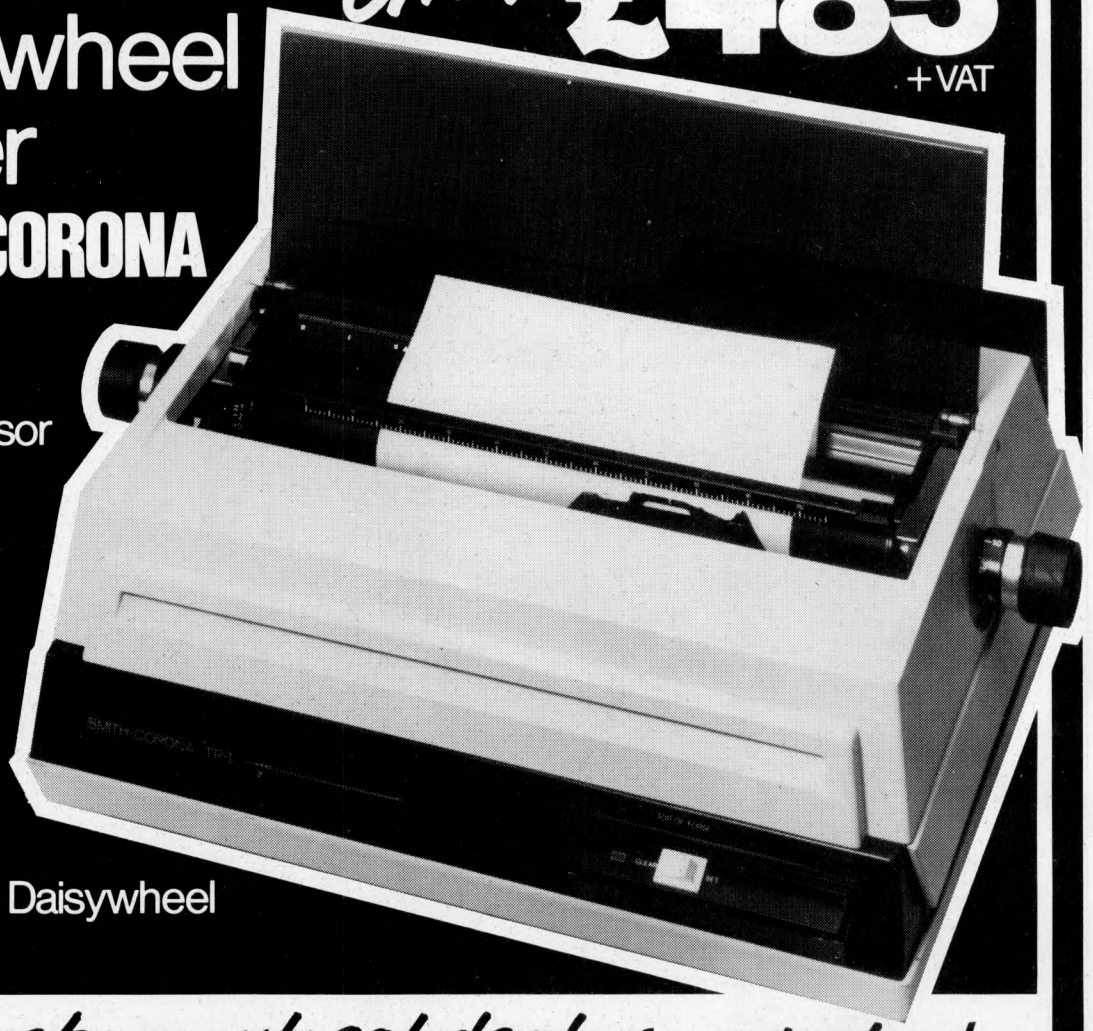

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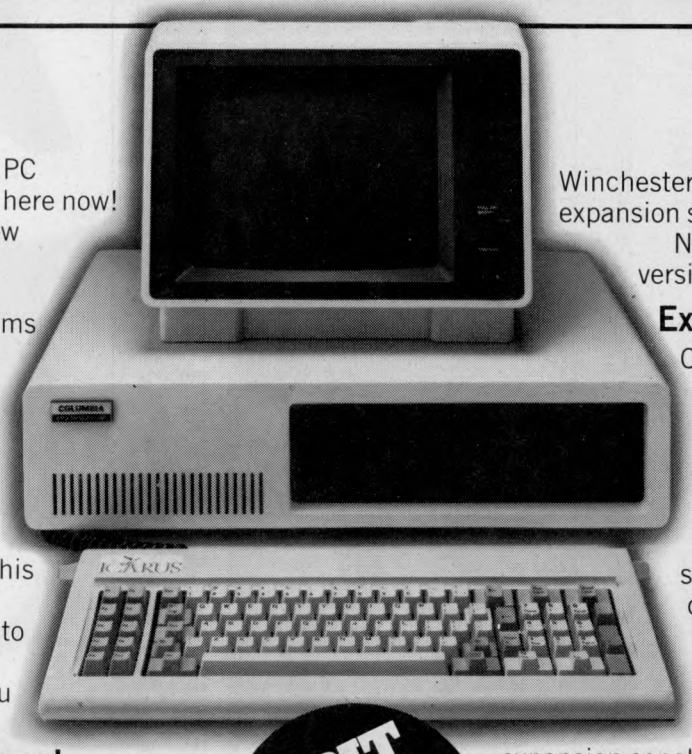

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	PET/CBM	£800	C1
	PET/CBM	£95/350	A1
	PET/CBM	POR	J1
	PET/CBM	£200	C2
	PET/CBM	£350	C7
	PET/CBM	£199	T5
	Sharp PC 3201	£300	P2
	Superbrain	£400	M3
	Superbrain	£300	S6
	Superbrain	£199	T5
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	Tandy Model I	£225	H1
	Tandy Model I	£225	T1
	Tandy Model II	£375	T1
	Vector	£400	C5
	8000 Series	£250	C2
	8080/Z80	£275	G3
	8080/Z80	£425	L1
S/L, P/L & stock control	Apple II	£900	P2
	Apple II	£1000	T2
	CP/M	£1000	L3
	CP/M	£900	B5
	Cromemco	£900	B5
	North Star Horizon	£900	B5
Solicitor's complete record accounting	Apple II	£3000	S2
Solicitor's package	Act Sirius 1	£1400	S1
	CBM/8032	£1400	S1
	Compucorp	£2000	Q1
	Superbrain	£1400	S1
	CP/M	£1250	M5
Statistics	Apple II	£150	G3
	Apple II	£100-195	P2
	Apple II	£140	C8
	Tandy Model I	£45	S2
Stock control/ recording	Altos (CP/M, MP/M)	£300	B1
	AppleII	POR	A2
	Apple II	POR	K2
	Apple II	POR	S5
	Apple II	£150	G3
	Apple II	£80	S2
	Apple II	£75/300	P2
	Apple II	£285	V1
	Apple II	£300	P1
	Apple II	£500	S4
	Apple II	£490	L4
	Apple II	£199	T5
	CBM/8032	£175	P3
	CBM/8032	£199	T5
	Challenger	£25	C7
	CP/M	£325	L1
	CP/M	£500-1500	C4
	CP/M	£350	G1
	CP/M	£900	M3
	CP/M	£700	B5
	CP/M	£550	B5
	CP/M	£550	B3
	CP/M	£300	W1
	CP/M	£500	T4
	CP/M	£550	M5
	CP/M	POR	B7
	CP/M	£199	T5
	Cromemco	£700	B5
	Famos	£1500	M2
	MZ-80K	£150	P2
	North Star Horizon	£450	B3
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	PCC 2000 Simpelec Triton 3	£350	B2
	PET/CBM	£12/25/ 350	A1
	PET/CBM	£195	I2
	PET/CBM	£300	B4
	PET/CBM	£15	A2
	PET/CBM	£300	B1
	PET/CBM	£150	C2
	PET/CBM	£150	J1
	PET/CBM	£150	G2
	PET/CBM	£250	R1
	PET/CBM	£35/25	H3
	PET/CBM	£199	T5
	Sharp PC3201	£300	P2
	Superbrain	£900	M3
	Superbrain	£300	S6
	Superbrain	£450	T3
	Tandy Model I	£30-50	M1
	Tandy Model II	£300	M1
	Tandy Model I	£48	S2
	Tandy Model I	£200	H1
	Tandy Model I	£115	J1
	Tandy Model I	£200	T1
	Tandy Model I	£375	T1
	8080/Z80	£275	G3
	8080/Z80	£325	L1
Surveying	CP/M	£500	T4
TAP business system	PET/CBM	£125	H2
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Time/cost recording	Act Sirius 1	£800	S1
	Apple II	£450	S2
	Apple II	£300	P1
	CBM/8032	£800	S1
	CP/M	£400	G1
	CP/M	£200	M3
	CP/M	£350	B3
	North Star Horizon	£250	B3
	North Star Horizon	£200	M3
	North Star Horizon	£450	W1
	PCC 2000 Simpelec Triton 3	£350	B2
	PET/CBM	£300	B1
	Superbrain	£200	M3
	Superbrain	£800	S1
	Tandy Model I	POR	M1
	Tandy Model II	POR	M1
Travel agency accts	Superbrain	£800	S6
	Tandy Model I	£225	G4
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Travel Agents Dairy	Tandy Model I	£100	G4
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	ITT 2020	£20	C6
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	CBM/8032	£375	P3
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	Apple II	£75	S5
	Apple II	£75	A2
	Apple II	£150-300	P2
	Apple II	£75	J1
	Apple II	£120	V1
	Apple II	£180/95	S4
	Apple II	£30	C8
	Apple II	£500	T2
	Apple II	£99	T5
	CP/M	£150-260	C4
	CP/M	£400	G1
	CP/M	£250	M3
	CP/M	£250	B6
	CP/M	POR	B7
	CP/M	£99	T5
	Famos	£500	M2
	North Star Horizon	£250	M3
	PET	£85/65/ 40/20	H2
	PET/CBM	£375	H4
	PET/CBM	£25/325	A1
	PET/CBM	£325	C5
	PET/CBM	£75/150	C2
	PET/CBM	£75/150	J1
	PET/CBM	£75/150	G2
	PET/CBM	£35	H3
	Superbrain	£250	M3
	Tandy Model I	£50/75	M1
	Tandy Model II	£175-240	M1
	Tandy Model I	£30/60/90	S2
	Tandy Model I	£45/95	J1
	Tandy Model I	£15	H1
	Vector	£400	C5
	8000 Series	£250	C2
Work In Progress	CP/M	£850	B5

Machines

ACT 800	Database management/	£225	H4
	Word processing	£375	H4
Act Sirius 1	Appointments planner	£115	C7
	Financial modelling	£595	A1
	Financial planning	£150	
	Incomplete records	£1200	S1
	Inn Management	£185	C7
	Insurance Broker	£450	C7
	Integrated Accts	£495	A1
	Invoicing	£95	C7
	Job Costing	£350	C7
	Motor Dealer	£345	C7
	Project Management	£245	C7
	Quotation Estimating	£125	C7
	Recruitment agency	£345	C7
	Solicitors package	£1400	S1
	Time/cost recording	£800	S1
	Video hire system	£125	C7
	Word processing	£295/325	A1
Altos (CP/M, MP/M)	Integrated accts	£300	B1
	Mailing list	£75	B1
	Stock control/recording	£300	B1
Apple II	Bill of materials	£199	T5
Budgeting	£125	T2	
	Cash flow	£80	V1
	Cash flow	£75	P2
	Cash flow	£100	C8
	Contract costing	£450	P1
	Database management/ information retrieval	£150	K2
	Database management/ information retrieval	£150	A2
	Database management/ information retrieval	£60-140	S2
	Database management/ information retrieval	£150	S5
	Database management/ information retrieval	£98	P2
	Database management/ information retrieval	£100	S4
	Database management	£75	P2
	Database management	£100	C8
	Database management	£125	T2
	Dental records	£395	M4
	Estate agent	£850	S5
	Estate agent	£850	A2
	Estate agent	£850	K2
	Estate agent	£750	S4
	Estate agent	£130	C8
	Financial modelling	£360	C8
	Financial modelling	£425-535	A1
	Financial planning	£250	S4
	Financial planning	£125	A1
	General ledger/NL	£300	K2
	General ledger/NL	£300	A2
	General ledger/N/L	£450	P2
	General ledger/NL	£300	S5
	General ledger/NL	£225	V1
	General ledger/NL	£295	C6
	General ledger/NL	£250P	S4
	General ledger/NL	£600	T2
	General ledger/NL	£490	L4
	General ledger/NL	£199	T5
	Hotel management	£525	M4
	Incomplete records	POR	K2
	Incomplete records	£250	S2
	Incomplete records	£450	P1
	Incomplete records	£450	P2
	Incomplete records	£490	L4
	Industry factory loading	£360	X1
	Industry work study	£990	X1
	Integrated accts	£885	V1
	Integrated accts	£450	P1
	Integrated accts	£300	P2
	Integrated accts	£600	T2
	Integrated accts	£300	W2
	Integrated accts	£1470	L4
	Integrated accts	£199	T5
	Invoicing	£295	S2
	Invoicing	£300	P2
	Invoicing	£140	V1
	Invoicing	£300	P1
	Invoicing	£300	T2
	Invoicing	£199	T5
	Job costing	£450	S2
	Job costing	£990	X1
	Job costing	£300	P1
	Job costing	£199	T5
	Letter writer	£99	T5
	Mailing list	£300	K2
	Mailing list	£300	A2
	Mailing list	£40	P2
	Mailing list	£50-150	S2
	Mailing list	£300	S5
	Mailing list	£100	S4
	Mailing List	£25	T2
	Mail shot	£14	S2
	Mail shot	£225	P2
	Mail shot	£99	T5
	Order entry/invoicing	£99	T5
	Order Processing	£99	T5
	Pad to plotter system	£250	P2
	Pad to plotter system	£180	C8
	Payroll	POR	S5
	Payroll	POR	K2
	Payroll	POR	A2
	Payroll	£200	S2
	Payroll	£375	V1
	Payroll	£200	P2
	Payroll	£375	C6
	Payroll	£250P	S4
	Payroll	£400	T2
	Payroll	£490	L4
	Payroll	£199	T5
	Personal records	£75	P2
	Postal advertising response package	£350	S2
	Production analysis	£75	P2
	Programming aids	£40	P2
	Purchase ledger	£300	K2
	Purchase ledger	£300	P2
	Purchase ledger	£300	A2
	Purchase ledger	£300	S5
	Purchase ledger	£315	V1
	Purchase ledger	£300	P1
	Purchase ledger	£295	C6
	Purchase ledger	£250P	S4
	Purchase ledger	£300	T2
	Purchase ledger	£490	L4
	Purchase ledger	£199	T5
	Quotation estimating	£300	P1
	Resource optimiser	£295	C10
	Sales ledger	£300	A2
	Sales ledger	£300	K2
	Sales ledger	£300	S5
	Sales ledger	£300	P2
	Sales ledger	£315	V1
	Sales ledger	£300	P1
	Sales ledger	£295	C6
	Sales ledger	£250P	S4
	Sales ledger	£300	T2
	Sales ledger	£490	L4
	Sales ledger	£199	T5
	SL, PL stock control	£1000	T2
	Solicitor's complete record accounting	£3000	S2
	Statistics	£150	G3
	Statistics	£100/195	P2
	Statistics	£100-195	P2
	Statistics	£140	C8
	Stock control/recording	£150	G3

PACKAGES

	Stock control/recording	POR	K2
	Stock control/recording	£300	P2
	Stock control/recording	POR	A2
	Stock control/recording	£80	S2
	Stock control/recording	POR	S5
	Stock control/recording	£285	V1
	Stock control/recording	£300	P1
	Stock control/recording	£500	S4
	Stock control/recording	£490	L4
	Stock control/recordin	£199	T5
	Text file librarian	£125	S4
	Time/cost recording	£450	S2
	Time/cost recording	£300	P1
	Utilities	£20	C6
	Video message	£200	G3
	Word processing	£75	K2
	Word processing	£75	A2
	Word processing	£60	S2
	Word processing	£300	P2
	Word processing	£75	S5
	Word processing	£120	V1
	Word processing	£75	J1
	Word processing	£180/95	S4
	Word processing	£30	C8
	Word processing	£500	T2
	Word processing	£99	T5
CBM/8032	Cheque writer	£90	P3
	General ledger/NL	£450	C11
	General purpose transaction proc.	£495	S3
	Insurance renewals	£1200	S3
	Integrated accts	£1500	P3
	Integrated accts	£900	C11
	Job costing	£1000	C11
	Motor trader	£950+	P3
	Order entry/invoicing	£750	P3
	Payroll	£375	P3
	Production control	£650+	P3
	Purchase ledger	£500	C11
	Sales ledger	£500	C11
	Solicitors package	£140	S1
	Stock control/recording	£175	P3
	Stock control/recording	£250	C11
	Time/cost recording	£800	S1
	Warehousing	£375	P3
Compucorp	Solicitors package	£2000	Q1
Challenger	Appointment Planner	£25	C7
	Invoicing	£25	C7
	Mail Shot	£25	C7
	Payroll	£25	C7
	Purchase Ledger	£25	C7
	Sales Ledger	£25	C7
	Stock Control	£25	C7
CP/M	Bill of materials	£500	B5
	Bill of materials	£199	T5
	Bookmakers package	POR	B7
	Budgeting package	£95	B5
	Cash flow	£250	L3
	Cash flow	£95	B5
	Cash register	£300	T4
	Company secretary	£450	C4
	Container accounting	£750	M5
	Contract costing	£2000	L3
	Database	£350	B3
	Database management/ information retrieval	£150-750	C4
	Database management/ information retrieval	£100	G3
	Database management/ information retrieval	£400	C3
	Database management/ information retrieval	£600	G5
	Dental records	£500	T4
	Eire payroll system	£650	M5
	Equipment lease/rent/ HP	£400	G1
	Estate agents	£750	C4
	Estate agent	£700	B5
	Financial modelling	£400	G1
	Financial modelling	£95	B5
	Financial modelling	£425/535	A1
	Financial modelling	£400	B6
	Financial planning	£125	A1
	General ledger/NL	£500	L3
	General ledger/NL	£500	C4
	General ledger/NL	£400	G1
	General ledger/NL	£375	L1
	General ledger/NL	£200	B5
	General ledger/NL	£275	S7
	General ledger/NL	£400	M3
	General ledger/NL	£350	B3
	General ledger/NL	£300	W1
	General ledger/NL	£425	B6
	General ledger/NL	£500	T4
	General ledger/NL	£400	M5
	General ledger/NL	POR	B7
	General ledger/NL	£199	T5
	Hotel management	£525	M4
	Incomplete Records	£250	B5
	Incomplete Records	£750	M3
	Incomplete Records	£975	B3
	Incomplete Records	£750	W1
	Incomplete Records	1250	M5
	Industrial cleaner package	POR	B7
	Industry factory loading	£360	X1
	Industry work study	£990	X1
	Insurance brokers	£995	W1
	Integrated accts	£1500	C4
	Integrated accts	£1100	G1
	Integrated accts	£950	L1
	Integrated accts	£690	B5
	Integrated accts	£850	S7
	Integrated accts	£990	M3
	Integrated accts	£900	B5
	Integrated accts	£1450	B3
	Integrated accts	£1200	B6
	Integrated accts	£199	T5
	Invoicing	£325	L1
	Invoicing	£150-350	C4
	Invoicing	£150	S7
	Invoicing	£250	M3
	Invoicing	£100	B5
	Invoicing	£200	B3
	Invoicing	£300	W1
	Inovicing	POR	B7
	Invoicing	£199	T5
	Job costing	£700	C4
	Job costing	£990	X1
	Job costing	£350	M3
	Job costing	£500	T4
	Job costing	£650	M5
	Job costing	POR	B7
	Job costing	£199	T5
	Job costing	£1500	T5
	Legal precedents	£1100	C4
	Letter writer	£150	M3
	Letter writer	£99	T5
	Mailing list	£50-150	C4
	Mailing list	£250	G1
	Mailing list	£75	S7
	Mail shot	£200-360	G4
	Mail shot	£90	M3
	Mail shot	£50/150	G5
	Mail shot	£99	T5
	Order entry/invoicing	£350	G1
	Order entry/invoicing	£500	T4
	Order entry/invoicing	£550	M5
	Order entry/invoicing	POR	B7
	Order entry/invoicing	£99	T5
	Order processing	£550	L1
	Order processing	£99	T5
	Payroll	£450	L3
	Payroll	£495	C4
	Payroll	£500	G1
	Payroll	£475	L1
	Payroll	£500	B5
	Payroll	£390	M3
	Payroll	£450	B3
	Payroll	Lease	W1
	Payroll	£425	B6
	Payroll	£500	T4
	Payroll	£450	M5
	Payroll	POR	B7
	Payroll	£199	T5
	Perpetual Inventory	£150	B5
	Personnel records	£450	C4
	Production analysis	£700	C4
	Property management	£450-1000	C4
	Property management	£400	M3
	Property management	POR	B7
	Purchase ledger	£500	L3
	Purchase ledger	£450	G1
	Purchase ledger	£425	L1
	Purchase ledger	£500	C4
	Purchase ledger	£200	B5
	Purchase ledger	£275	S7
	Purchase ledger	£400	M3
	Purchase ledger	£350	B3
	Purchase ledger	£300	W1
	Purchase ledger	£425	B6
	Purchase ledger	£500	T4
	Purchase ledger	£400	M5
	Purchase ledger	POR	B7
	Sales ledger	£500	L3
	Sales ledger	£500	C4
	Sales ledger	£450	G1
	Sales ledger	£425	L1
	Sales ledger	£200	B5
	Sales ledger	£275	S7
	Sales ledger	£400	M3
	Sales ledger	£350	B3
	Sales ledger	£300	W1
	Sales ledger	£425	B6
	Sales ledger	£500	T4
	Sales ledger	£400	M5
	Sales ledger	POR	B7
	Sales ledger	£199	T5
	Solicitors	£1250	M5
	S/L, P/L + stock control	£1000	L3
	S/L, P/L + stock control	£900	B5
	Stock control/recording	£325	L1
	Stock control/recording	£500-1500	C4
	Stock control/recording	£350	G1
	Stock control/recording	£500	B5
	Stock control/recording	£900	M3
	Stock control/recording	POR	B7
	Stock control	£550	B3
	Stock control	£300	W1
	Stock control	£500	T4
	Stock control	£550	M5
	Stock control	£199	T5
	Surveying	£500	T4
	Time/cost recording	£400	G1
	Time/cost recording	£200	M3
	Time ledger	£350	B3
	Utilities	£50	B5
	Various thermal insullation industry systems	£2000+	T6
	Word processing	£400	G1
	Word processing	£150-260	C4
	Word processing	£250	M3
	Word processing	£250	B6
	Word processing	POR	B7
	Word processing	£99	T5
	Work in progress	£850	B5
Famos	Customer file	£1000	M2
	Data base	£1500	M2
	Integrated accts	£2000	M2
	Motor dealer	£5000	M2
	Payroll	£1500	M2
	Stock control	£1500	M2
	Word processing	£500	M2
MCZ Zilog	Mail shot	£250	I1
	Membership accting	£250	I1
	Personnel records	£400	I1
MZ-80K	Estate agent	£195	W1
	Integrated accounts	£150	P2
	Stock control/recording	£150	P2
North Star Horizon	Budgeting package	£95	B5
	Cash flow	£95	B5
	Database management/ information retrieval	£250	B3
	Double glazing costing	£750	W1
	Estate agent	£750	B5
	Financial modelling	£95	B5
	General ledger/NL	£250	B3
	General ledger/NL	£400	M3
	General ledger/NL	£400	B5
	Incomplete records	£750	M3
	Incomplete records	£250	B5
	Incomplete records	£975	B3
	Integrated accts	£950	B3
	Integrated accts	£990	M3
	Integrated accts	£690	B5
	Integrated accts	£900	B5
	Invoicing	£100	B3
	Invoicing	£250	M3
	Invoicing	£100	B5
	Job costing	£350	M3
	Letter writer	£150	M3
	Miling List	£195	W1
	Mail shot	£90	M3
	Payroll	£350	B3
	Payroll	£390	M3
	Payroll	Lease	W1
	Property Management	£400	M3
	Purchase ledger	£250	B3
	Purchase ledger	£400	M3
	Purchase ledger	£400	B5
	Sales ledger	£250	B3
	Sales ledger	£400	M3
	Sales ledger	£400	B5
	SL, PL + stock control	£900	B5
	Stock control/recording	£450	B3
	Stock control/recordng	£900	M3
	Time/cost recording	£250	B3
	Time/cost recording	£200	M3
	Time/cost recording	£450	W1
	Word processing	£250	M3
PCC 2000 Simpelec Triton 3	Estate Agent	£350	B2
	General ledger/NL	£350	B2
	Mail Shot	£450	B2
	Purchase ledger	£350	B2
	Sales ledger	£350	B2
	Stock control/recording	£350	B2
	Time/cost recording	£350	B2
PET/CBM	Assembler dev	£50	C2
	Bill of materials	£199	T5
	Bureau de change	£8	H3
	Cash flow	£8	A1
	Cheque writer	£90	P3
	Credit control	£650	B4
	Database management/ information retrieval	£75	B1
	Database management/ information retrieval	£50/150	C2
	Database management/ information retrieval	£150	G2
	Database management/ information retrieval	£150	J1
	Database management/ information retrieval	POR	C1
	Database management/ information retrieval	£325	A1
	Database management/ information retrieval	£225	H4
	Database management/ information retrieval	£250	C3
	Disk operating system	£150	B1
	Estate agent	£25	A1
	Estate agent	£30	H3
	File handling	£225	H4
	Financial modelling	£425-535	A1
	Financial planning	£125	A1
	General ledger/NL	£200	C2
	General ledger/NL	£1000	C1
	General ledger/NL	£200	H3
	General ledger/NL	£199	T5
	Industry factory loading	£300	X1
	Industry work study	£750	X1
	Integrated accts	£300	B1
	Integrated accts	£(50)	C2
	Integrated accts	£650	G2
	Integrated accts	£650	J1
	Integrated accts	£800	S3
	Integrated accts	£199	T5
	Invoicing	POR	J1
	Invoicing	£25-50	B1
	Invoicing	£350	A1
	Invoicing	£400	C1
	Invoicing	£199	T5
	Job costing	£750	X1
	Job costing	£199	T5
	Lotteries	£45	H2
	Mailing list	£75	B1
	Mailing list	£15	A1
	Mailing list	£45	H2
	Mailing list	£35	H3
	Membership accting	£85	H2
	Payroll	£150	G2
	Payroll	£150	J1
	Payroll	£150	C2
	Payroll	£50/195 195	I2
	Payroll	£50/25/ 195	A1
	Payroll	POR	C1
	Payroll	£200/350	C5
	Payroll	£10	H3
	Payroll	£199	T5
	Personnel recors	£85	H2

PLUTO

INTELLIGENT COLOUR GRAPHICS

Pluto provides YOUR machine with a high quality Colour Graphics Display.

Meet the Family:-
BABY PLUTO... 320(H) x 288(V) x 8 Colour. 96K bytes of memory to provide two full screen buffers.
PLUTO..... 640(H) x 288(V) x 8 Colour. 192K bytes of memory to provide two full screen buffers.
Double resolution option..... 640(H) x 576(V) x 8 Colour. Software selectable between 288(V) & 576(V).
Start with Baby and then Upgrade!

Pluto *uses the latest technology to provide unprecendented performance and reliability on a single PCB.*
Pluto *may be readily connected to most Computer Systems or plugged straight into an 80-BUS or NASBUS.*

Look at what **Pluto** *offers:-*

- 16 bit Intel 8088 microprocessor.
- 192K bytes of dual-ported display memory for fast flicker-free screen updates. *(Outside the host address space).*
- Fast parallel I/O interface usable with ALMOST ANY COMPUTER.
- Operates from a single +5v supply..

Here are just some of the high level functions that **Pluto** *provides:-*

- Fast vector draw – over 100,000 pixels/sec. Lines can be drawn using REPLACE, XOR, AND, OR functions.
- Built-in character set providing an 80 x 28 character display.
- User definable characters or symbols.
- Spare display memory with memory management facilities for allocating symbol storage space or workspace.
- Rectangle Fill and Copy using nine logic functions.
- Fast access to single pixels.
- Write protected memory planes during copy.
- Double buffered screen memory for animated displays.
- Complex polygon colour fill.

Pluto *is also available as a boxed unit with integral power supply with cables and connectors and custom interface card for a range of machines:-*

PET, APPLE, SIRIUS, NASCOM, GEMINI, RAIR, RML, S100 etc.

Our range of interfaces is being continuously expanded, please ask us for details of others including RS 232.
Pluto is expandable. *Available very soon is an expansion board enabling* **Pluto** *to display 256 colours simultaneously from a very large palette for producing high quality shaded images.*

Pluto *prices:-*

BABY PLUTO	£299.00 plus VAT
PLUTO	£399.00 plus VAT
BOXED PLUTO AND INTERFACE	£599.00 plus VAT
DOUBLE RESOLUTION OPTION	£50.00 plus VAT
8MHz PROCESSOR OPTION *(40% speed improvement)*	£50.00 plus VAT

(Carriage £6.00 on boxed **Pluto**)

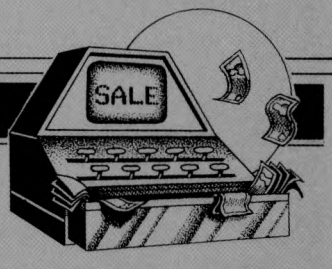
Dealer and OEM enquiries invited.

io research ltd. 6 Laleham Avenue · Mill Hill · London NW7 3HL
Telephone: 01-959 0106

PACKAGES

	Petsoft programs	£160	J1
	Petaid report generator	£250	S3
	Prise lister	£12	H3
	Production analysis	£300	B1
	Production control	£650+	P3
	Purchase ledger	£200	C2
	Purchase ledger	POR	J1
	Purchase ledger	£95/120 350	A1
	Purchase ledger	£1000	C1
	Purchase ledger	£300	B4
	Purchase ledger	£350	H3
	Purchase ledger	£199	T5
	Sales ledger	POR	J1
	Sales ledger	£200	J1
	Sales ledger	£300	B4
	Sales ledger	£800	C1
	Sales ledger	£95/350	A1
	Sales ledger	£350	H3
	Sales ledger	£199	T5
	Stock control/recording	£150	C2
	Stock control/recording	£300	B1
	Stock control/recording	£150	G2
	Stock control/recording	£150	J1
	Stock control/recording	£195	I2
	Stock control/recording	£12/25/ 350	A1
	Stock control/recording	£15	A2
	Stock control/recording	£300	B4
	Stock control/recording	£35/25	H3
	Stock control	£199	T5
	TAP business system	£125	H2
	Time/cost recording	£300	B1
	Utility set	£78	H3
	VAT	£17.50	A1
	VAT master	£25	H3
	Word processing	£75/150	J1
	Word processing	£75/150	G2
	Word processing	£75/150	C2
	Word processing	£85/65	
		£40/20	H2
	Word processing	£375	H4
	Word processing	£25/325	A1
	Word processing	£325	C5
	Word processing	£35	H3
PET/ Computhink	Stock control/recording	£250	R1
RAIR Black Box	Financial modelling	POR	A3
	Hotel management	POR	A3
	Local government housing maint.	POR	A3
Sharp PC-3201	General ledger	£450	P2
	Sales ledger	£300	P2
	Purchase ledger	£300	P2
	Stock control	£300	P2
Sorcerer	Payroll	£250	L2
Superbrain	Bill of materials	£450	T3
	Database	£300	S6
	Estate agent	£800	S6
	Estate agent	£600	C12
	General ledger	£400	M3
	General ledger	£400	S6
	Incomplete Records	£750	M3
	Incomplete Records	£1200	S1
	Integrated accts	£1200	S6
	Integrated accts	£990	M3
	Integrated accts	£1000	T3
	Integrated accts	£1200	S1
	Invoicing	£250	M3
	Invoicing	£150	S6
	Job costing	£350	M3
	Letter writer	£150	M3
	Mailing list	£140	C9
	Mail shot	£90	M3
	Payroll	£400	S6
	Payroll	£390	M3
	Payroll	£250+	T3
	Property management	£400	M3
	Purchase ledger	£300	S6
	Purchase ledger	£400	M3
	Sales ledger	£300	S6
	Sales ledger	£400	M3
	Sales ledger	£199	T5
	Solicitors package	£1400	S1
	Stock control	£300	S6
	Stock control	£900	M3
	Stock control	£450	T3
	Time/cost recording	£800	S1
	Time recording	£200	M3
	Word processing	£250	M3
	Travel agency accts	£800	S6
Tandy Model I	Database management/ information retrieval	£25-80	M1
	Database management/ information retrieval	£270	A4
	Database management/ information retrieval	£60	S2
	Database management/ information retrieval	£32.50	H1
	Database management/ information retrieval	£150	J1
	General ledger/NL	£90	M1
	General ledger/NL	£90	M1
	General ledger/NL	£225	H1
	General ledger/NL	£225/325	T1
	General ledger/NL	£425	T1
	Incomplete records	£40	M1
	Incomplete records	£40	H1
	Invoicing	£90	M1
	Invoicing	£280	A4
	Invoicing	£90	M1
	Invoicing	£75	T1
	Invoicing	£125	T1
	Integrated accts	£350	M1
	Integrated accts	£550	A4
	Integrated accts	£350	M1
	Integrated accts	£75	J1
	Investment portfolio	£20	S2
	Invoicing	£25	H1
	Job costing	POR	M1
	Job costing	POR	M1
	Mailing list	£40	M1
	Mailing list	£75	M1
	Mailing list	£25/38/ 55	H1
	Mailing list	£50-150	S2
	Mail shot	£75+	G4
	Mail shot	£160	A1
	Mail shot	£75	M1
	Mail shot	£75+	G4
	Payroll	£249	M1
	Payroll	£200	H1
	Payroll	£218	T1
	Payroll	£375	T1
	Purchase ledger	£90	M1
	Purchase ledger	£90	M1
	Purchase ledger	£225	H1
	Purchase ledger	£375	T1
	Purchase ledger	£375	T1
	Sales ledger	£90	M1
	Sales ledger	£90	M1
	Sales ledger	£225	H1
	Sales ledger	£225	T1
	Sales ledger	£375	T1
	Statistics	£45	S2
	Stock control/recording	£30-50	M1
	Stock control/recording	£300	M1
	Stock control/recording	£200	H1
	Stock control/recording	£48	S2
	Stock control/recording	£115	J1
	Stock control/recording	£200	T1
	Stock control/recording	£375	T1
	Travel Agency Accts	£225	G4
	Travel Agency Accts	£225	G4
	Travel Agents Dairy	£100	G4
	Travel Agents Diary	£100	G4
	Travel Ticket Sales	£225	G4
	Travel Ticket Sales	£225	G4
	Time/cost recording	POR	M1
	Time/cost recording	POR	M1
	VAT register	£15	H1
	Video hire system	£460	A4
	Word processing	£50/75	M1
	Word processing	£175-240	M1
	Word processing	£45/95	J1
	Word processing	£15	H1
	Word processing	£30/60/ 90	S2
Vector	General ledger/NL	£400	C5
	Integrated accts	£1000	C5
	Purchase ledger	£400	C5
	Sales ledger	£400	C5
	Word processing	£40	C5
8000 Series	Database management/ information retrieval	POR	C2
	Integrated accts	POR	C2
	Payroll	£250	C2
	Purchase ledger	£250	C2
	Sales ledger	£250	C2
	Word processing	£250	C2
8080/Z80	General ledger/NL	£275	G3
	General ledger/NL	£375	L1
	Integrated accts	£950	L1
	Integrated accts	£995	G3
	Invoicing	£325	L1
	Job order control	£257	G3
	Order processing	£550	L1
	Payroll	£475	L1
	Payroll	£275	G3
	Prof appts groups	£275	G3
	Prof appts individ	£220	G3
	Prof client billing	£330	G3
	Purchase ledger	£425	L1
	Purchase ledger	£275	G3
	Sales ledger	£275	G3
	Sales ledger	£425	L1
	Stock control/recording	£325	L1
	Stock control/recording	£275	G3

TRANSACTION FILE



Readers will be pleased to know that, due to our clever layout ideas, the Transaction File is up-to-date and waiting cut down considerably. Ads are accepted only on the form below for a flat fee of £2.50. Please don't specify issues as we can't oblige. Ads cannot be repeated unless separate forms are sent in. We will only accept entries from non-commercial readers. Thank you for co-operating.

Wanted 32-64k 80 column microcomputer/word processor. Part package capable of modification considered. Also required vg quality electric typewriter/printer especially if interfacable. Cash paid. Tel: 01-575 0511 anytime (evenings preferred).

ZX81 — + 16k RAM. Sinclair complete: leads, manual, etc. £87.50 (inc postage). ZX printer £49.50 (inc postage). Write to: Rod Postans, 300 Amhurst Rd, Stoke Newington, London N16.

Sharp MZ80K — 48k five months old still under guarantee. Still in packing, plenty of software, also manual. Must sell £365. Tel: Russell (0792) 794816.

Sharp PC1211 — + cassette interface. Still in box, all manuals etc. £70. Tel: 01-527 3572.

ZX81 — Sinclair built inc 16k RAM. As new, perf cond., hardly used, in box with leads, adaptor & manual. Genuine reason for sale. Tel: Nottingham 285010.

Acorn Atom — 12k RAM, FP ROM, leads, psu, manuals, magic book, Galaxian, Invaders & other software £150 ono also 3k RAM (6 x 2114) £5. Tel: Sedgefield 20403 after 5pm.

Acorn Atom — 12k + 12k. 6522 VIA chip, printer plug, psu, manuals, also £50 plus of software £225, or would consider ZX81 + cash. Tel: Sheffield 0742 339147.

ZX81 — mounted in Fuller case with keyboard 16k RAM all vgc, manual, all leads 2 games £100. Tel: Farnham (0252) 711162 after 4pm or weekends.

Atom — 12k + 12k lots of software/books. Factory assembled £200 ono. Potts, 4 Littleway, Dunsford Hill, Exeter, Devon.

ZX81 16k RAM all Sinc built original box leads & manual exc cond. quick sale wanted £60 ono. Tel; 01-398 2750 (Esher).

ZX81 — with 16k RAM & games tape, Sinclair built, £80. Tel: 021 354 6438 eve.

TI 994/A — complete. Little used, cost £300 will accept £160 ono. Features good T.I. maths, sound and graphics. Tel: Harrogate (0423) 58588.

SWTP — 69A, SS50 Bus, 6809 40k Statis RAM + 16k socketed card. 2 serial ports, 20 amp supply. Full data, easily modified to a S/09 £600 ono. Tel: 01-422-4724.

Video Genie 16k — keyboard/ lower case/sound mode. Acculab Floppy tape. Over £150 in software inc Basic 4, books + manual £500 R. Beattie. Lincoln 730421 ext 423 (daytime).

PCW's - all issues from vol 1. no 1 except 4, £25. Tel: Biggin Hill 74089.

BBC Computer — Model B. As new, with games software, leads, mnual & cassette recorder, £350 ono. Tel: Guildford 71255 ext. 3099, office hours only.

PET 2001 — 32k small keyboard plus 4022 printer for sale, together price £600. Consider P/ex for printer & interface for compustar M30/40. Tel: 0135 39441 daytime, Cooden 3194 eve.

ZX81 — + 16k RAM Sinc built. Housed in matching console with power switch. Software, tapes, books + cassette player. Bargain at £80 ono. Tel: 01-950 6365 after 6pm.

Disk system — twin 8in single-sided drives with PS's in cabinets, double-density controller for S-100 bus, cables £650, can sell separately. Tel: John Gaeth 01-861 8798.

ZX81 — 16k RAM, PSU, Sinc built still under guarantee + manual, leads, games, business education & chess cassettes £95. Tel: 0742 364834.

ZX81 — + 16k RAM Sinclair built, for £90. All leads, manual etc. Five software tapes '30 programs for the ZX81', five months warranty remaining worth over £130. Tel: 01-808 0620.

TRANSACTION FILE

✶TRS80 — LII, 16k hardly used, new ROM, numeric keypad, all leads & manuals plus books, games & software. £320 ono. Tel: 01-995 4506

✶Apple II — Europlus single disk, manuals lots of programs guaranteed £940. Tel: Wrexham 263123 weekdays. Stratford-upon-Avon 298187 weekends (P. Howard). Also Sharp MZ80K manuals 100+ programs D/cover documentation £320.

✶ZX81 — 16k almost new. £20 worth of programs, Galaxians, chess etc. £100 ono also Atari games console with 6 games £90. Bargain. Tel: 01-767 4732 after 5pm.

✶ZX81 — 1k machine. A bargain for anyone, inc all leads & transformer. Also over 80 programs. This computer must go, only £65 ono. Tel: 0772 52473 eve.

✶Acorn Atom — 12k RAM + F.P. ROM, psu, all leads, manual, magic book, games (inc Invaders), as new £220 ono. Tel: 0279-51356 (Bishop's Stortford) - evenings.

✶Atom — 8k + 12k new keyboard VIA power supply, all leads, magic book & getting acquainted with Atom, Acornsoft, Invaders cassette, the Atom magazines. £200. Gibson. tel: Leeds (0532) 869826.

✶Sharp M80K — 48k RAM in box, Basic Space Invaders, Zen assembler, etc. £350 ono, Kings Lynn area. Tel day 0553 64216 eve/w.ends 672304.

✶PET — 8k, 1yr old with new ROM. Separate cassette and soundbox. Games & manuals, £450. Tel: Long Eaton, (Nr Nottm) 65633.

✶CBM — 4016 + cassette, manuals, assembler/Memfix, wordpro, games over £250 of s/ware, magazines etc. £550 ono. Tel: Farningham (Kent) 863604.

✶5V 6A Profesional psu — 4 @ 1.5A module. Cermet adjustable o/put 4.08/5.91 vdc. 11 transistors, 4 Zeners. Every conceivable feature. 125mmx95mmx58mm per module. £36 or will split. Steve 0553 86618 K. Lynn.

✶Decwriter LA36 printer terminal — fitted with Accelwriter mod. 600/300/110 baud. gc. RS232 interface £275 ono. Systems group 64k S100 bank switching RAM. Best offer over £300. Tel: 0670 712624 eve.

✶ZX81 — 16k RAM, Sinc built (still under guarantee) with leads, psu, manual, two machine code, books + lots of progs. Cost £130 accept £80 ono. Phone Newcastle (0632) 629357 after 5.

✶S100 blank card — with power lines, IC pads: £15. Mullen extender with logic probe: £30. IBM 3982 printer, Sorcerer interface, manual, (mechanical fault) £100. Porthtowan (0209) 890688 Cornwall.

✶UK101 — 8k RAM, cased with cassette recorder and numerous progs, cassettes, books. Bargain at £160 ono. Luton 594539 eve.

✶ITT 2020 — 32k with disk drive and paddles, all manuals + chess, adventure etc, £850 ono. Southend on Sea (0702) 204901.

✶Nascom double drive — G809, G815/2 disk system with CP/M 2.2. Complete with s/ware and mint cond. Quick sale. Phone Alan on 021 373 0562.

✶TRS80 — LII, 16k, system, inc EPSON printer, cables & interface, paper, many progs etc. All exc cond. £700 ono. Tel: Steve 01-303 0513.

✶Sharp PC1211 — pocket computer and CE-122 printer with cassette, psu, spare batteries, extensive s/ware, carrying case, k/board overlay. £110 ono. Phone 0629 81 3664 except Wednesday and Saturdays. Delivery by registered post.

✶ZX81 — 16k RAM + type kboard, all leads, cassettes and books. 3 months old, £105 ono. Also ZX80 inc leads etc. £25, both little used, Tel: 01 428 9310 (Watford).

✶Genie 1 — 16k + sound, 3 months old, hardly used & in exc cond. + 2 joysticks & lots of software incl Arcade games & adventures £300. Tel: Ezra after 6pm, (01) 45 89002.

✶Nascom 2 — 32k RAM NAS-SYS3 Graphics, prof. built & cased Pascal Zeap Disdebug 8k Basic, 2-4k baud, motor controlled recorder, Centronics interface, lots of software & manuals £430 ono. Tel: Bob 01-450 8911 (ext 337) daytime.

✶Apple software — on cassettes for sale. Games & utilities. Send SAE or tel Tim on Leamington Spa 38997 after 12 for price list and details.

✶ZX81 — + 16k & all leads & manual + adaptor + £33 of books, software incl 3D Monster Maze. Worth £135 sell for £80 (will arrange postage) Tel: 061-707 3493 (still under guarantee).

✶TRS80 — Model III 48k green screen, dual double-density drives giving 360k storage. Model VII printer all under 6 months old, complete with extensive software books etc £1500 ono Tel: 01-699 8350.

✶ZX81 — +16k + joystick + over 100 program listings, only £120. Tel: Worcester 840742.

✶Nascom I — with NASYS 3 and PIO chip built & working £100. Power supply £25 ono all documentation supplied. Tel: 0977 556018 after 7.30pm week days or weekend anytime.

✶PET — 32k new ROM 2001. Toolkit superchip & pic-chip ROMS. Fitted cassette deck, dust cover, exc. condition £550 incl many programs & books. Tel: 0303 863160.

✶ZX81 — +16k RAM pack & Fuller Fulsize keyboard. All leads & 9v adapter (over 160 progs), a real bargain at £136 (as new costs over £180). For details tel: Wokingham 784002 after 6.15pm.

✶ZX81 — Sinc built + 16k RAM power supply All leads, manual, two games + the the ZX81 companion hardly used, 4 months old £85. Tel: Jim 01-854 5065.

✶Texas T199/4A — only few months old with 3 modules, money management chess & attack games + accessories bought for £400, must sell £350 ono. Tel: Slough 76952

✶PET — 8k old ROM recently overhauled, new video board & keyboard. Some business software & many games. External cassette deck & integral deck. Good condition £260 ono. Tel: 01-940 2077.

✶Video Genie — 16k plus sound plus games programs plus light pen. In original box with manuals & leads, £225. Tel: Congleton 71869 eve. or weekends.

✶ZX81 — +16k RAM Sinclair built, perfect cond, leads, manual, psu, etc. At least 12 excellent 16k programs £80 ono. Tel: Cliff on 01-863 3832 after 5pm.

✶Teletype Westrex 33 — complete with keyboard tape punch & all electronics. 20mA loop input. USed with TRS80 but suitable for other micros vgc. Ashurst, Southampton. Tel: 042129 3284 eve. £95.

✶Atari 800 — 32k with recorder, joysticks, comprehensive manuals & five cartridges, inc assembler. Exc cond, best offer around £700. Texas T159 card programmable vgc £60. Tel: 09064 22996 Littlehampton Sussex.

✶Free Ladybord book — when you buy my TRS80 L2 16k inc T-Bug Galazy, Blackjack, Backgammon, Morse etc. manuals, books, mags 6 months pristine cond, leads VHF £315. Tel: Hengoed (0443) 815136.

✶TRS80 — Level II 16k with VDU, CTR-80 cassette & software inc chess, backgammon etc. £350 ono. Tel: 01-348 6925.

✶GP-80 — suit Atom/BBC parallel interface, 5 x 7 lower case, graphics characters, hi-res graphics, double width, tractor feed, self-test, manual, 5 months under guarantee, 26-way cable, paper, cost £230 accept £180. Tel: (0472) 48531.

✶Printer — SWTPC type PR-40 matrix printer' 40 columns, upper case, plain paper, parallel interface, for Basic listings etc £60 Tel: 01-637 0703 after 7pm.

✶TRS80 — line printer VII absolutely, as new, sell for £190 ono. Tel: Farnham Common (028 14) 5951

✶Atari VCS — 14 cartridges inc. Asteroids, Chess. Also keyboards and programming cartridge. Worth over £400. Exc cond. Original packing, sensible offers to: Mr Beaver, 16 Poulton St, Ashton, Preston, Lancs.

✶Acorn Atom — 12k + 12k, unused manual, leads etc. £180 ono. Tel: (0734 787886) after 7.

✶TRS80 — LII, 16k Tandy cassette and vdu, loudspeaker, 9 manuals £150+ s/ware, major games and adventures + editor assembler master monitor. Pascal US80 magazines vgc. only £305 Tel Bristol 0272 503848.

✶Sharp PC1211 — computer, CE121 cassette interface, instruction manuals, application manual. 1 month old, upgrading. Cost £130, offers to David after 5pm please. Tel: Kingston Blount (0844) 51201.

✶UK101 — cased with Watford motherboard, 24k RAM, EPROM board, Cegmon, new Basics 3&4, 600 baud, parallel (centronics) printerface, 5amp PSU, £210 ono. Batch, Rugby 76341 day 71750 eve/w.ends.

✶Video Genie — 16k RAM, 12k ROM + sound leads etc. Plus over £500 s/ware inc Invaders,

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Asteroids, Adventures, utilities worth £850. Selling for £450 ono. Phone 0742 302665.

✱ ZX81 — manual, leads, also inc 3 of the popular ZX81 games books plus cassette of 6 games inc golf and sub-attack £49. Phone (0628) 72629 eve.

✱ VIC20 — C2N cassette and Teach Yourself to Programme, ie manual with 2 cassettes, as new. Cost £250 — £185 ono. Tel: Cramlington (Northumberland) 0670 716196.

✱ ENM parallel printer. (Licensed Centronics copy) 5x7 Dot Matrix. Width adjustable to 132 characters. TTL logic. Tractor feed. Heavy duty contruction cables. Ink ribbons £75 ono. Tel: 0553 86 618 Steve.

✱ ZX81 — +16k RAM, Sinc built, manual, leads, 2 games cassettes, 1 game & 2 m/c books all for £85. vgc. Contact Mark, 173 Mayfield Gardens, Brentwood, Essex. Tel: (0277) 232439.

✱ Centronics 101A — £75. LX180 with stand £175. Thermal printer £45. Petitvid £35. ASCII kboard £20. Nascom2 copy, Zeap, Naspen, Debug etc. £245, 073477 5438 Wokingham, Berks.

✱ Atari VCS — & cartridges, Asteroids, M/Command, S/Invaders, Adventure Superman, Skydiver, Combat Air/Sea Battle. Tel: Earldoms 318 Salisbury Wilts. £180 ono.

✱ PET — 32k large keyboard with Basic 4.0 upgrade & cassette deck. Command-0 ROM. More than 100 programs incl in price £525 ono. Tel: 0235 831449.

✱ ZX81 — complete with powerpack, 16k (Sinclair), leads, manual, book. Many large taped programs, Defenders, Nightmare Park, Zombies, Galactic Wars, CUBE, Tank & many more £65 ono, Tel: Capel Bangor (097084) 411.

✱ PAL — T199/4 home computer, colour graphics + sound. 16k RAM + software as new £230 ono. Also Microtan 65 with damaged but working keypad £40. Tel: Headley Down 713012 weekends or after 6pm.

✱ MZ80k games — 16k, six games incl Lunar Rescue, Breakout, Star Fighter, all fast graphical games £6.95. Send cheque or p/o to Paul Grant, 81 Frenchwood Ave, Preston, Lancs.

✱ Teletype — Datadynamics 390 with paper tape reader & punch, vgc quiet operation 20mA current loop interface £150 ono. Tel: 01-360 5354.

✱ Tandy Model III — business system (48k twin disk RS232), line printer vi, all bought from Tandy software. Scripsit, 12 Adventures, Edtasm & more. Owner going CP/M! Tel: Bracknell 24277 or Knowle 78218.

✱ Superboard III — 8k RAM, 10k ROM, rosewood case, Basic 5 new Basic 4, 8k Eprom board, psu & manual. Exc condition. Tel: (0222) 831246.

✱ BBC Microcomputer Model B 32K. Mint unopened and guaranteed with games paddles. To the first enthusiast fed up with waiting £420. Tel: 01-445 2114 day; 01-349 9370 eve & weekends.

✱ UK101 — 8k RAM cased, separate psu. 300/600 baud cass Mon01,Mon02,WEMON. Extensive documentation: manuals, programs cassettes, games & practical. £155 Tel: (0723) 68786 work, 78421 home.

✱ ZX81 — 16k RAM Sinc built as new, 2 Sinc games cassettes. Asteroids, golf, Breakout, leads, manual. 10 months old £99 ono. Tel: Whitburn (West Lothian) 0501-40469

✱ MK14 — RAM I/O extra RAM, revised monitor, replacement keyboard, boxed, manuals etc £40 ono. Tel: 0367 (Faringdon) 21631 eve.

✱ Acorn Atom — 12k RAM 12k ROM psu, only 5 months old, hardly used, manual & leaflets £185. Contact Wayne Davis, The Archer Arms, Lewannick, Launceston, Cornwall PL15 7QD.

✱ Acorn Atom — 2k RAM + 8k ROM with leads, manuals & software (incl 2 Acornsoft packs) £120 ono. 164 Alexandra Rd South, Manchester M212RB. Tel: 061-881 5641.

✱ KSR 33 RO — Printers, stands as new £100, older £60. 4k x 1 Dram (MCM 6605) with circuit 32/£4. ET1 System 68 Microsystem, CUTS, TTY, VDU, RAM, D/A, NCU, PSU, card frame, working £70. Tel: 01-289 7415.

✱ Texas T159 — & PC100C both little used & as new. With Master Library, magnetic cards, programming pads, printing paper & many programs, £175. Tel: Keith Basingstoke 881586.

✱ ZX81 — + 16k Sinc built. Fuller keyboard, software books & cassettes incl 3d Monster Maze, leads, power, supply, manual £110. Tel: Harpenden 60701 John Clamp.

✱ Video Genie — EG3003 hardly used. Still under warranty. £230 o.n.o. Deliver within 50 miles of Newbury else collect. Tel 063 527 587.

✱ TRS80 Level 2 16K — as new. All leads and manuals. Over £100 software inc. microchess, asylum, invaders, level 4 basic, scripsit, editor assembler and lots more £300 o.n.o. Tel Little Haywood 881 468

✱ VIC20 — 8K RAM cassette unit, joystic, etc; still under guarantee plus cartridge and cassette games, books etc. All worth over £400. Will accept £300 o.n.o. Phone 021 360 1736 after 6pm.

✱ ATARI — television game with 13 games cartridges including space invaders, chess, superman, missile command, pele soccer etc. Everything in excellent condition. £220 Phone Sunderland 841194 evenings only.

✱ VIC20 — cassette unit several cartridges & books including Vic revealed and book on assembly language programming. £50 of programs worth £450 + will accept £350 o.n.o. Tel 0656 50696 evenings.

✱ APPLE 2+ — 64K, disc drive DOS 3.3, eurocolour card, serial/parallel interface, joystick. Works perfectly. Boxed. Best offer or £1250. 'Phone Bethersden (Kent) 316 after 8pm. Uncased monitor £45. Kaga £110.

✱ WordPro — 4+ and Visicalc for sale. I have decided to save up for Silicon office and must reluctantly part with these excellent programmes. 1st come 1st served. Redhill 60986 24-hrs.

✱ TermiNet 1200 — Printer, 1200 baud, RS232 interface, vgc, £115, CASE200 monitor £20. Tel: Uxbridge 30617 evening.

✱ PETITE 32K — add on memory for PET. Complete in case with PUS. Hardly used. Perfect condition. £100 o.n.o. Tels: 0604 412785 evenings. Buyer collects.

✱ CBM/PET — 4032-32K plus cassette, tapes, books, £500. Also 4022 printer complete with cable and paper £400. or both for £850 o.n.o. hardly used. Ring Wisborough Green (0403) 700777 evenings.

✱ APPLE II — 48K Europlus, two disc drives plus controller virtually unused, boxed. New unwanted gifts £1150 (might split) Phone Hatfield 71524 after 6.00pm.

✱ ZX81 — Sinc built, 1K, one cassette lead, TV lead, manual, mains adaptor + plug. £45.00. Casio — VL-tone perfect condition + case, 100 note memory synthesiser, rhythms. £29.95 Tel: Robert (061) 902 0980

ZX81 — + 16K RAM sinclair built PSU leads manual plus three Sinclair cassettes (2 games 1 business) £80. Oxford (0865) 779257

✱ 48K Sorcerer — £350 o.n.o., tapes (inc word processor, toolkit machine code tutorial, galaxians, cadas, ESC games tape) manuals cables and all back copies of ESC. Taylor 01-272 5896 after 6.00.

✱ Acorn Atom — 8K ROM 9K RAM PSU TV & tape leads all manuals some software Acorn assembled. Excellent condition, hardly used, ready to run. £155 Mr C. Dineen, Grove House, Fermoy, Cork, Ireland.

✱ ATARI CX2600 video computer system with combat, video olympics casino cardridges. Plus extra pair of paddles for 4-player games. Cost £150, accept £85 for quick sale. Tel: Billericay (02774) 55850.

✱ ATARI 800 — 48K, 410 program recorder, joysticks, etc. As new condition. Over £200 games software. Swap for Apple II Europlus in similar condition, or sell for first £450. Tel: 031 331 3651.

✱ Two Casio 502p's — with 256 program steps and 21 non volatile memories £40 each, also one FA-1 cassette interface £10. All excellent condition, ask for Paul 01-736 3596 after 7pm.

✱ Video Genie — Sound box, extra keys, manuals + leads. Over £300 software incl. editor/ass, T-Bug, Mon 3 and many arcade games. £350 o.n.o. Tel Disley (06632) 3271.

✱ ZX81 + 16K RAM — Sinclair built, manual, transformer, leads, software, (inc. 'Monster Maze', Bug-byte M/code assembler + disassembler), 'Mastering machine code' book. Perfect condition. £85 o.n.o. Tel: 0243 785560. W. Young.

✱ Apple — Pascal language system. B/W modulator. Desktop plan. Circuit analysis. GoodsPell. Visicalc. Typing tutor. Offers: Wanted — Apple disk drive. Tel: 0205 750365 Mitchell.

✱ ZX81 — Sinc built + 16K RAM, power supply, Sinclair cassettes, Startrek, ZXBUG, etc in original boxes and in excellent condition. £110 o.n.o. Telephone Castleton (N. Yorks) 667.

✱ Genie 1 48K — colour sound. Joy sticks, monitor, centronics 739 printer, many progs. Complete ready to go. £1,250. Seikosha GP80A printer £130. All approx 6 months old. Tunbridge Wells (0892) 23206.

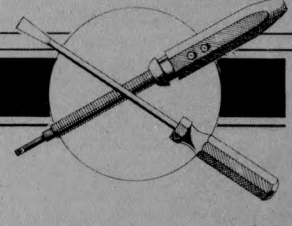
✱ VIC-20 Casssette unit — software programs, and Joystick, six months old, price £230 o.n.o. Contact Chris on Merthyr Tydfil 77173.

✱ Genie I — 48K on board. Full keyboard, lower case, sound, and prog. sound, plus ACULAB floppy tape, 20 wafers, keypad and joystick. Extensive software £230 o.n.o. for quick sale. Leicester (0533) 898850.

✱ PET 3032 — with EPSON TX-80 printer and cassette deck. Games, utilities, cassettes, paper. All in perfect condition. Bargain at £575 George Sobala, 90 Old Road, Headington, Oxford.

✱ VIC 20 — as new, original packaging. plus cassette unit. Offers above £200. Tel: Bracknell (0344) 25179.

ACC NEWS



Rupert Steele presents his monthly round-up of news from the Amateur Computer Club

Yes, personal computing *does* exist outside London On 24-25 July this year 'Microfest '82' was held at UMIST (that's in Manchester for those who have never ventured north of Watford). This was a combination of exhibition and seminars, and was a great success. Needless to say, the ACC was there with our club database, which was in great demand as we put hundreds of people in touch with their local clubs.

Of course, we didn't know where *all* the clubs in the North-West area; while we may be truly wonderful, the ACC aren't telepathic, and if you don't bother to tell us of your existence, then we can't tell anybody else about it. So hurry along there and send the details of your club to Peter Whittle, 49 Bartlemas Road, Oxford, OX4.

Peter was there with me, and frequently deserted me on the stand to visit the various talks that were going on. Steve Adams gave a thorough discussion of the internals of the Sinclair Spectrum with a talk 'Inside the Spectrum' and, among others, there was a talk on telesoftware, for which Peter got roped into helping (hindering?) the presentation.

As a result of the various discussions that went on during the show, it looks as if there is going to be an Association of North-Western Computer Clubs, along the lines of the ALCC, for the Manchester area. Several of this, and the business is being coordinated by David Wade of the Manchester Computer Club: his address is 28 Hazel Road, Altrincham, Cheshire; 061 941 2486.

The general atmosphere at Microfest was very positive and friendly; the emphasis was strongly on the hobbyist sector rather than the expensive business machines, and

ACC NEWS

there was a lot of educational work going on; not only were some of the seminars on Computers in Schools, but there were a lot of teachers visiting the show. The Sinclair Spectrum was the machine of the show; they were everywhere. (But where was the Beeb machine? Its keepers Acorn were nowhere to be seen.)

The organisers were so pleased with the show that they are planning a repeat performance at UMIST on 11-12 December. They have asked the ACC to organise the club stands (there was a problem at Microfest in that many clubs who might have gone didn't know about it), so any club wanting to go should contact David Annal, the ACC's exhibition man, at 142 Windermere Road, London, SW16 5HE. We'll mention this in our next club circular (but then this only goes to clubs who have told us of their existence).

The ACC's AGM is coming up soon, so it's not long before the membership gets it its annual chance to be really nasty to the committee (it's the other way round for the rest of the time). It will be at 2pm at the Polytechnic of North London, Holloway Road on 16 October 1982. Rumour has it that somebody *even* more important than our chairman, Peter Whittle, will address the meeting.

The next *PCW* Show is coming up soon. The ACC is organising the clubs area in the new, expanded, improved Show. See you there, either around the club stands or on the ACC stand itself.

A few people gave me information at Microfest, and one or two have written to me. A Mr Ian Thornton-Bayer of 25 Southfield Drive, West Bradford, Clitheroe, Lancs BB7 4ZU; tel (0200) 25933, wants to set up a local club and is interested in communicating with like-minded individuals locally. So is Mr G M Flanaghan, of 11 Sundown Close, New Mills, Stockport, Cheshire, SK12 3DH; tel (0663) 44051. Also David Webb of 4 Ashfield. Dewsbury, West Yorks.

While we are up north, Mr King of the Holmes Chapel Computer Club, 3 Jodrell Close, Holmes Chapel, Crewe, Cheshire CW4 8BU would be glad to hear from anybody in the area thinking of joining. Going across the country to the North-East, I hear that Harrogate Junior Chamber is running a competition called 'MAC '82', the results of which will be announced at a Computer Fair in the Royal Bath Assembly Rooms, Harrogate, on 6 November 1982. For more information, write to Robert Hopkins, 54 Crimple Meadows, Parral, Harrogate, North Yorks HG3 1EN.

Prestel. . . there is going to be an official club area on Prestel at the *PCW* Show for the Computer Clubs to publicise themselves and to set up telesoftware for other people to download. This area will be numbered 8008 and will be administered by the ACC. For more details about what is proposed contact Peter Whittle. The ACC's pages, starting at 292500, should indicate when 8008 is going, and you should be able to request 8008 information by use of a response frame. Prestel still rather too expensive for you? Watch this space. . . like calls Europe, Prestel might cost less than you think.

I am now in a position to describe more fully Peter's attempts to communicate via modems with some people in Rome. The idea was to make a demonstration for a high technology festival in Rome, which was part of an arts festival that was on there. The people were very interested in what was going on in personal computing in the UK and said that there was no Italian home computer user movement, as there seems to be in this country. They were also very interested in Prestel and general datacomms, so the following was done:

They were running an Apple with a 300 baud acoustic coupler, while Peter was running a 380Z with a GPO modem. After a fair amount of setting up (described below), the 380Z was set up to emulate a dumb terminal down the modem line, and the Apple was set to remote mode. Therefore the Apple in Rome was run from the 380Z in Oxford, over the phone system. The it was run the other way round, and thr Apple was used to run the 380Z over the phone. In the live demonstration, a chess program was run on the 380Z and played in Rome.

It is absolutely essential to have carrier detect lights on the modems, and it is convenient to have the use of two phone lines. Otherwise, it is impossible to talk to the operator at the other end to ask how things are going. Therefore, each user watches the carrier detect light on his modem coupler; if this goes out, it usually means that the guy at the other end wants to talk.

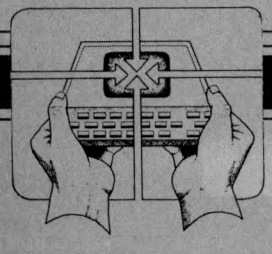
Most of the lines to the States are simplex, with voice detection turn-around, which is not possible for data. However, within Europe most of the lines are duplex and therefore suitable for data use. One thing that has to be done is to switch off the echo suppressors on the line by sending a 2.1 KHz tone for three seconds at the start of the call.

Setting up is easily done in originate mode; after making telephone contact, the originator should listen for the whistle from the answer modem; this should be detected by the originate modem (when you connect it), which then should light the carrier detect. If it doesn't, check the positions of the originate/answer switches on both modems (one should be orig, the other answer; the orig and answer data are modulated on different frequencies, so it is essential that the modems are listening to each other's frequencies, rather than both talking on one frequency, both listening on the other). If this doesn't identify the fault, make sure that your modems are the right system, namely CCITT V21 standard; the American Bell 103 system is not compatible with the CCITT international standards, so beware acoustic couplers from the States or Japan.

At this point, the answer end should detect the originate end's carrier, and the link should work. The easiest test is to short the send and receive RS232 connections at one end (but see RS232 handshakes below!) and type away at the other to see if anything appears on the screen (computer set up to emulate terminal). This technique is known as using a loop-back.

If there are problems, it is advisable to check that the RS232 handshakes are correct for both the modem and the computer. The following should occur:
1. Set DTR true (Data Terminal Ready — pin 20). This tells the modem to connect to the line.
2. Set RTS true (Request To Send — pin 4) This tells the modem to turn its carrier on.
3. DCD (Data Carrier Detect — pin 8) should go true.
4. DSR (Data Set Ready — pin 6) also goes true.
5. CTS (Clear To Send — pin 5) goes true. When CTS is true, the system thinks that everything is okay and is ready to go.

Note that if your computer RS232 interface doesn't have modem control you will need to set DTR and RTS yourself. Another tip; if CTS is true but nothing is happening, try all possible combinations of swapping connections of pins 2 and 3 at both ends since it is quite likely that these (data send and receive) have got connected the wrong way round at one end or the other.



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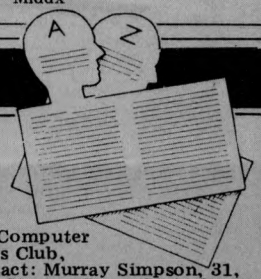
USER GROUPS INDEX



These are alterations and additions to the complete listing published in the August issue. The next full listing will appear in the February 1983 edition

International

Laserbug-user group for the BBC Micro. Originally based in London but due to countrywide enquiries is now operating nationally. Monthly magazine, local and larger meetings to be held. Membership £12pa or send £1 for a sample copy of the magazine to: Laserbug, 4, Station Bridge, Woodgrange Road, Forest Gate, London E7 ONF.

'68 Micro user Group. Newly formed. Newsletter planned, regular meetings. Contact: Jim Anderson, 41, Pebworth Road, Harrow, Middx HA1 3UD.

International Electronic Spreadsheet User Group, for all interested in Visicalc, Supercalc and other spreadsheet packages. Information exchange. Membership £15.00 including subscription to Spreadsheet newsletter, published bi-monthly. Details from: InterCalc (UK), Alpha House (7th Floor), Rowlandsway, Manchester M22 5RG.

National

Atom User Group: Contact Peter Frost, 18, Frankwell Drive, Potters Green, Coventry CV2 2FB. Quarterly newsletter, software library. Membership £4pa.

Towns

Basildon Computer Club. Meetings 1st & 3rd Fridays monthly. Contact: Pete Silver, 24, Havengore, Pitsea, Essex SS13 1JT. Tel: Basildon 726141

Bournemouth TRS-80/Video Genie User Group. Meetings twice monthly. Contact: D Washford, 1, Alexandra Road, Bournemouth BH6 5JA. Tel: 0202 761122 (day), 0202 423064 (evening).

Is anyone interested in forming a computer club in Caerphilly/Cardiff? If so, please contact me, Nigel, on Caerphilly 884315 after 5pm.

Fife Computer User's Club, Contact: Murray Simpson, 31, Tom Stewart Lane, St Andrews, Fife, KY16 8YB.

Leeds Microcomputer Group-Secretary's new address, 27, Richmond Road, Leeds LS6. Venue for meetings: British Telecom House, Leeds.

Southgate Technical College Computer Club. Meetings, talks and demonstrations welcome, beginner or guru. Contact: Kevin Pretorius, 01-882 2282 (after 6pm) for details.

NETWORK NEWS

These are all the European networks of which we're aware. Most are free — but phone them for details.

Forum-80 Hull. . . (Forum-80 H,Q) Tel: 0482 859169, System operator Frederick Brown. International electronic mail, library for up/down loading software. Forum-80 Users Group, Pet Users section shopping list system hours, 7 days a week midnight to 8.00am, Tues/Thurs 7.00pm to 10.00pm Sat/Sun 1.00pm to 10.00pm.

Forum-80 London. . . Tel: 01-747 3191. System operator Leon Jay. Electric mail, library for downloading. System hours: Tues/Fri/Sun 7.00pm to 11.00 pm.

Forum-80 Milton. . . (TRS-80 Users Group 80-Net) Tel: 0908 566660. System Operators: Leon Heller and Brian Pain. Electronic mail, library, newsletter, TRS-80 information system hours: 7 days a week 7.00pm to 10.00 pm.

Forum-80 Holland. . . Operator: Nico Karssemeyer, tel 01 313 512 533. Facilities: electronic mail, program up/downloading, shopping list. Hours: Tues-Sat 1800-0700 nightly, continuous from 1800 Sat — 0700 Tues.

CBBS London. . . Operator: Peter Goldman, tel 01-399 2136. Facilities: electronic mail, program downloading. Hours: Wed 0700-0930 & 1900-2200, Fri 1900-2200, Sun 1600-2200.

Mailbox-80 Liverpool. . . 051-220 9733, System Operator: Peter Tootill, Electronic mail, downloading TRS-80 information.

ACC. . . members bulletin board, Peter Whittle (0908 44262)

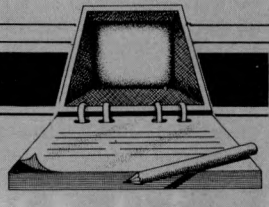
ABC-80. . . Stockholm, Sweden) Tel: 010 468 190522.

University Research Computer. . . Sweden. Tel: 010-468 23660, guests use password "66,66" for access.

Elfa. . . Sweden 010 468 7300 706

Tree Tradet. . . Sweden 010-468 190522.

DIARY DATA



Readers are strongly advised to check details with exhibition organisers before making arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.

Leeds	(Exbn Centre) Yorkshire Business to Business Exbn. Contact: Solent Exbns Ltd, Bournemouth 20327	2-4 Nov
London	(Wembley Conf Centre) Software Expo. Contact: Interco Business Consultants, Ltd. 01-948 3111	8-10 Nov
Romania	(Bucharest) Electronic Component, Computing & Telecommunications Equip Exbn (ELTRON). Contact: Publicom Publicity Agency, Bd N, Balescu 22, Bucharest.	9-12 Nov
Dublin	Irish Electronics Exbn (ITRON). Contact: SDL Exbns Ltd, Dublin 763871	23-25 Nov
Birmingham	(Albany Hotel) Computer Open Day Exbn Contact: Couchmead Communications Ltd, 01-778 1102	24 Nov
Harrogate	(Exbn Centre) North of England Electronics Exbn. Contact: Exbns For Industry Ltd, Oxted 4371	7-9 Dec
Dubai	Golf Computer Exbn. Contact: Trade Centre Management Co, 01-930 3881	13-16 Dec

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ZX81 Star Trek

This game is rather like the standard 'Star Trek' to play and is very well written, using as it does machine code and the INKEY$ function. The use of INKEY$ unfortunately means that it cannot be run on the ZX80 without changing the program by using INPUT instead. A lot of POKEs to the screen are used also which adds further conversion difficulties.

The machine code inverts a window in the middle of the screen which is used as the scenario for the game. This would be of use in other ZX81 programs especially if one knew machine code and could alter the screen parameters. The use of machine code also means that the program should be saved before it is run.

Instructions are included in the program and these are very complicated — not at all easy to take in at one reading. It is helpful to remember that although you are allowed to input numbers with a decimal point for warp factor, this will spoil the display and make it harder to read. The basic idea is, of course, to blow up as many Klingon ships as possible before running out of energy — which you can replenish by calling at starbases. The program can be made more difficult or easier by changing the distance between bases (line 3510), changing the frequency of Klingon attack (line 3410) or changing the amount of energy available (lines 1050 and 5300).

```
 10 REM ..............................
 20 DIM Q$(56)
 21 LET Q$="2A0C4006A0C5062023 7EFE7F3804DE8
   1802C6807710F123C110EAC9"
 22 LET X=16514
 23 FOR I=1 TO 28
 24  LET N=16*(CODE (Q$(1))-28)
 25 LET N=N+CODE (Q$(2))-28
 26 POKE X,N
 27 LET Q$=Q$(3 TO )
 28 LET X=X+1
 29 NEXT I
 30 RAND
100 DIM C$(6)
110 DIM P$(5)
120 DIM T$(5)
130 DIM S$(4)
140 DIM R$(3)
150 DIM H$(17)
200 LET H$="S T A R   T R E K"    (inverse video)
210 PRINT AT 5,8;"▬▬▬▬"
220 PRINT TAB 12;"▚  ▬▬▬▬"
```

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PROGRAMS

```
230 PRINT TAB 13;"▚  ▞"
240 PRINT TAB 13;"▀▀▀▀"
250 PRINT AT 13,7;
260 FOR I=1 TO 17
270 PRINT H$(I);
280 NEXT I
290 PRINT AT 18,0;"DO YOU WANT INSTRUCTIONS?"
300 INPUT A$
310 IF A$="YES" OR A$="Y" THEN GOSUB 9800
500 REM *DISPLAY*
510 CLS
520 PRINT "thirty two graphics H characters"
530 FOR I=1 TO 9
540 PRINT "graphic H, thirty black squares, graphic H"
550 NEXT I
560 PRINT "nine graphic H, USS ENTERPRISE (inverse video),
    nine graphic H"
570 PRINT " STARDATE 1000";TAB 21;"ENERGY 5000"
580 PRINT "CONDITION GREEN";TAB 21;"SHIELD DOWN"
590 PRINT "WARP 1   VECTOR 1    SENSORS OFF"
600 PRINT "PHASERS READY";TAB 21;"TORPEDOS 10"
610 PRINT "DAMAGE 0";TAB 21;"SCORE  0"
999 REM*INITIALISE*
1000 LET S$="DOWN"
1010 LET C$="GREEN"
1020 LET T$="READY"
1030 LET R$="OFF"
1040 LET P$=T$
1050 LET E=5000
1060 LET W=1
1070 LET D=0
1080 LET DATE=1000
1090 LET E$="thirty two spaces"
1100 LET S=PEEK 16396 +256*PEEK 16397 +35
1110 LET ST1=S
1120 LET ST2=S
1130 LET SS=0
1140 LET SCORE=0
1150 GOSUB 3400
1160 LET SH=0
1180 LET Z$="five spaces"
1190 LET DOCKED=0
1200 LET WE=1
1210 LET WMAX=9
1220 LET NT=10
1230 LET P=1
1240 LET V=1
1250 GOSUB 3500
1260 LET U$="eleven black squares"
2000 REM ** MAIN LOOP **
2010 LET DATE=DATE+1
2020 LET E=E-W*W-SH*10-SS*5-15*(D>0) -5
```


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PROGRAMS

```
2030 IF E<=Ø THEN LET E=Ø
2040 PRINT AT 11,1Ø;DATE;TAB 28;"four spaces";
     AT 11,28;E
2050 IF E=Ø THEN GOTO 32ØØ
2100 IF W=Ø THEN GOTO 225Ø
2110 POKE ST1,128
2120 POKE ST2,128
2130 LET ST1=S+INT (RND*9)*33+RND*1Ø
2140 LET ST2=S+INT (RND*9)*33+(RND*10+18)
2150 POKE ST1,151
2160 POKE ST2,151
2170 LET BD=BD+W
2180 IF BV=V THEN LET BD=BD-W*2
2200 IF W<8 OR KV<>V THEN GOTO 23ØØ
2205 IF DK>3 THEN GOTO 221Ø
2206 LET DK=2
2207 GOSUB 56ØØ
2210 LET DK=DK+2+(W=9)
2220 IF DK>2Ø THEN GOSUB 34ØØ
2300 LET DK=DK-(DK>Ø)
2310 IF BD<1 AND NOT DOCKED THEN GOSUB 5ØØØ
2400 IF SS AND (DK<3) THEN GOSUB 82ØØ
2500 IF NOT DK THEN GOSUB 9ØØØ
2600 IF D=Ø THEN GOTO 27ØØ
2610 IF DK THEN LET D=D-1Ø
2620 IF D<1Ø THEN GOSUB 4Ø3Ø
2630 PRINT AT 15,7;Z$;AT 15,7;D
2700 GOSUB 3ØØØ
2800 IF (D>4Ø) AND RND<(W*W/2ØØØ +.ØØ1) THEN GOSUB 55ØØ
2900 GOTO 2ØØØ
2999 REM **********************
3000 LET A$=INKEY$
3010 IF A$="" THEN RETURN
3020 IF A$="W" THEN GOSUB 8ØØØ
3030 IF A$="S" THEN GOSUB 81ØØ
3040 IF A$="P" THEN GOSUB 7ØØØ
3050 IF A$="Z" THEN GOSUB 85ØØ
3060 IF A$="B" THEN GOSUB 86ØØ
3070 IF A$="V" THEN GOSUB 88ØØ
3080 IF A$="T" THEN GOSUB 41ØØ
3090 IF A$="E" THEN GOSUB 4ØØØ
3100 RETURN
3200 REM **OUT OF ENERGY**
3210 PRINT AT 19,0;"OUT OF ENERGY.MISSION TERMINATED" (inverse)
3220 LET A$="AN ABSOLUTE DISASTER"
3230 IF SCORE>5 THEN LET A$="TERRIBLE"
3240 IF SCORE>2Ø THEN LET A$="QUITE GOOD"
3250 IF SCORE>4Ø THEN LET A$="VERY GOOD"
3260 IF SCORE>6Ø THEN LET A$="EXCELLENT"
3270 IF SCORE>1ØØ THEN LET A$="KLINGON ZAPPER SUPREME"
3280 PRINT "YOUR PERFORMANCE IS RATED AS"
3290 PRINT A$
```


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PROGRAMS

```
3295 STOP
3400 REM **RESET KLINGONS**
3410 LET DK=INT (RND*1Ø+1Ø)
3420 LET NK=INT (RND*3+1)
3430 LET KV=INT (RND*8+1)
3440 LET C$="GREEN"
3445 PRINT AT 12,1Ø;C$
3450 IF SS THEN PRINT AT 17,Ø;E$;AT 17,Ø;"NO
     KLINGONS IN SENSOR RANGE"
3460 RETURN
3500 REM **RESET STARBASE**
3510 LET BD=INT (RND*2ØØ+2ØØ)
3520 LET BV=INT (RND*8+1)
3530 RETURN
3600 REM*PAUSE ROUTINE*
3610 FOR T=1 TO 25
3620 NEXT T
3630 RETURN
3700 REM*CLEAR LINES 20,21**
3710 GOSUB 36ØØ
3720 PRINT AT 2Ø,Ø;E$;AT 21,Ø;E$
3730 RETURN
3800 REM *LEAVE STARBASE*
3810 LET DOCKED=Ø
3820 GOSUB 35ØØ
3830 PRINT AT 2,12;U$;AT 3,13;U$;AT 4,1Ø;U$;
     AT 5,11,U$
3840 RETURN
4000 REM *EMERGENCY REPAIRS*
4005 IF E>D+35Ø THEN GOTO 4Ø25
4010 PRINT AT 2Ø,Ø;"NOT ENOUGH ENERGY FOR REPAIRS"
4015 GOSUB 37ØØ
4020 RETURN
4025 LET E=E-35Ø
4030 REM *GENERAL REPAIRS*
4035 IF WMAX=9 THEN GOTO 4Ø6Ø
4040 LET WMAX=9
4045 PRINT AT 18,Ø;"WARP ENGINES REPAIRED.MAX WARP=9"
4050 GOSUB 36ØØ
4055 PRINT AT 18,Ø;E$
4060 LET WE=1
4065 LET P=1
4070 LET P$="READY"
4075 LET D=Ø
4080 IF R$="OUT" THEN LET R$="OFF"     (nb. "OUT" is inverse)
4082 IF S$<>"OUT" THEN GOTO 4Ø9Ø          "       "
4084 LET S$="DOWN"
4086 LET SH=Ø
4090 PRINT AT 11,28;"four spaces";AT 11,28;E;AT 13,29;R$;
     AT 14,8;"four spaces";AT 14,8;P$;AT 15,7;"Ø    "
4092 PRINT AT 12,28;S$;AT 16,Ø;E$
```


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PROGRAMS

```
4095 RETURN
4100 REM *PHOTON TORPEDOS*
4110 IF NT THEN GOTO 414Ø
4120 PRINT AT 2Ø,Ø;"NO TORPEDOS"
4125 GOSUB 37ØØ
4130 RETURN
4140 IF DK=Ø THEN GOTO 4162
4150 PRINT AT 2Ø,Ø;"TARGET OUT OF RANGE"
4155 GOSUB 37ØØ
4160 RETURN
4162 IF S$<>"UP  " THEN GOTO 417Ø          (nb 2 spaces in string)
4164 PRINT AT 2Ø,Ø;"SHIELD MUST BE DOWN TO FIRE"
4165 PRINT "TORPEDOS"
4166 GOSUB 37ØØ
4168 RETURN
4170 PRINT AT 3,16;"+";AT 5,13;"=";AT 5,19;"=";
     AT 7,16;"-"                (nb all symbols in inverse video)
4175 PRINT AT 2Ø,Ø;"TORPEDO SYSTEM ACTIVE"
4180 LET K=S+3
4190 FOR I=1 TO 5
4200 POKE K,147
4210 POKE K+1,146
4220 POKE K,128
4230 POKE K+1,128
4240 LET K=K+36
4250 NEXT I
4260 FOR I=1 TO 4
4261 LET UU=USR 16514
4262 FOR J=1 TO 1
4263 NEXT J
4264 NEXT I
4270 LET NT=NT-1
4280 LET NK=NK-1
4281 LET SCORE=SCORE+1
4282 PRINT AT 15,28;SCORE
4290 IF NT AND NK THEN GOTO 418Ø
4300 PRINT AT 3,16;"■";AT 5,13;"■";AT 5,19;"■";
     AT 7,16;"■"
4310 PRINT AT 14,3Ø;"  ";AT 14,3Ø;NT
4320 IF NK THEN GOTO 44ØØ
4330 GOSUB 34ØØ
4370 GOSUB 37ØØ
4380 RETURN
4400 GOSUB 37ØØ
4410 PRINT AT 2Ø,Ø;"TORPEDOS OUT";AT 21,Ø;NK;
     "KLINGONS LEFT"
4415 GOSUB 37ØØ
4420 RETURN
5000 REM **STARBASE**
5010 LET W=Ø
5015 PRINT AT 13,5;W
5020 PRINT AT 2,12;"■■■ ■■■"
```


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PROGRAMS

```
5030 PRINT AT 3,13;"▄▀▀▀▄"
5040 PRINT AT 4,1Ø;">=▄ ▄▀▀▀▄ ▄=<"
5050 PRINT AT 5,11;"▀▄ ▀▄▄▄▄▄▀ ▄▀"
5060 IF DK>2 THEN GOTO 53ØØ
5070 PRINT AT 2Ø,Ø;"DANGER. KLINGON ATTACK"
5080 PRINT AT 2,12;U$;AT 3,13;U$;AT 4,1Ø;U$;AT 5,11;U$
5090 LETZ=S+147
5100 LET Z1=Z-36
5110 LET Z2=Z-3Ø
5120 LET Z3=Z+3Ø
5130 LET Z4=Z+36
5140 FOR I=1 TO 4
5150 POKE Z1,151
5160 POKE Z2,8
5170 POKE Z3,6
5180 POKE Z4,Ø
5190 POKE Z1,128
5200 POKE Z2,128
5210 POKE Z3,128
5220 POKE Z4,128
5230 LET Z1=Z1-36
5240 LET Z2=Z2-3Ø
5250 LET Z3=Z3+30
5260 LET Z4=Z4+36
5270 NEXT I
5275 LET DOCKED=Ø
5280 GOSUB 35ØØ
5285 PRINT AT 2Ø,Ø;E$
5290 RETURN
5300 LET E=5ØØØ
5305 LET DOCKED=1
5310 LET NT=NT+2*(NT<8)+(NT=9)
5315 PRINT AT 14,3Ø;NT
5320 GOSUB 4Ø3Ø
5325 LET BD=Ø
5330 RETURN
5500 REM *METEORITE SHOWER*
5510 LET TV=INT (RND*(WMAX/2)+1)
5520 LET WMAX=WMAX-TV
5525 IF WMAX<1 THEN LET WMAX=1
5530 PRINT AT 18,Ø;"METEORITE SHOWER. DAMAGE TO WARP
     ENGINES. MAX WARP = ";WMAX
5540 GOSUB 36ØØ
5550 PRINT AT 18,Ø;E$;AT 19,Ø;E$
5560 IF W<=WMAX THEN RETURN
5570 LET W=WMAX
5580 PRINT AT 13,5;W
5590 RETURN
5600 REM *ESCAPED KLINGONS*
5610 LET C$="GREEN"
5620 PRINT AT 12,1Ø;C$
```


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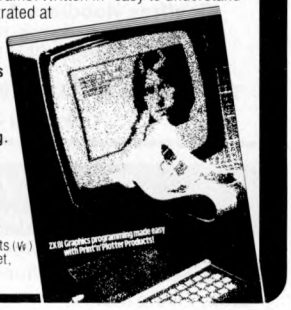

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PROGRAMS

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 5630 RETURN
 6000 REM *PHASER ROUTINE*
 6010 FOR I=1 TO 1Ø
 6020 NEXT I
 6030 LET K=S+23
 6040 FOR I=1 TO 8
 6050 POKE K,147
 6060 POKE K+1,146
 6070 IF INKEY$<>"" AND E>5Ø THEN GOTO 619Ø
 6080 POKE K,128
 6090 POKE K+1,128
 6100 LET K=K+31
 6110 NEXT I
 6120 RETURN
 6190 LET E=E-5Ø
 6191 LET UU=USR 16514
 6192 FOR J=1 TO 2
 6193 NEXT J
 6194 LET UU=USR 16514
 6195 IF K=S+147 THEN GOTO 63ØØ
 6210 GOTO 6Ø8Ø
 6301 POKE K,128
 6302 POKE K+1,128
 6305 LET NK=NK-1
 6306 LET SCORE=SCORE+1
 6307 PRINT AT 15,28;SCORE
 6310 RETURN
 7000 REM **PHASERS**
 7010 IF P THEN GOTO 7Ø4Ø
 7020 PRINT AT 2Ø,Ø;"PHASERS ARE OUT"
 7025 GOSUB 37ØØ
 7030 RETURN
 7040 IF NOT DK THEN GOTO 7070
 7050 PRINT AT 2Ø,Ø;"TARGET OUT OF PHASER RANGE"
 7055 GOSUB 37ØØ
 7060 RETURN
 7070 IF E>50 THEN GOTO 71ØØ
 7080 PRINT AT 2Ø,Ø;"NO ENERGY FOR PHASERS"
 7085 GOSUB 37ØØ
 7090 RETURN
 7100 PRINT AT 3,16;"+";AT 5,13;"=";AT 5,19;"=";
      AT 7,16;"-"                          (nb inverse video)
 7105 PRINT AT 14,8;"ARMED";AT 2Ø,Ø;"PHASERS
      ARMED AND READY"                          " "
 7110 GOSUB 6ØØØ
 7115 PRINT AT 11,28;"four spaces";AT 11,28;E
 7120 IF E<5Ø THEN GOTO 72ØØ
 7130 IF NK=Ø THEN GOTO 715Ø
 7140 GOTO 711Ø
 7150 GOSUB 34ØØ
```


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PROGRAMS

```
7160 PRINT AT 14,8;"READY"
7180 PRINT AT 3,16;"■";AT 5,13;"■";AT 5,19;"■";
     AT 7,16;"■"
7185 PRINT AT 2Ø,Ø;EØ
7190 RETURN
7200 PRINT AT 2Ø,Ø;EØ;AT 2Ø,Ø;"ENERGY BANKS DRAINED"
7210 PRINT NK;" KLINGONS LEFT";AT 14,8;"OUT    " (nb OUT is inverse)
7215 GOSUB 37ØØ
7220 GOTO 718Ø
8000 REM *CHANGE WARP*
8005 IF WE THEN GOTO 8Ø25
8010 PRINT AT 2Ø,Ø;"WARP DRIVE OUT OF ACTION"
8015 GOSUB 37ØØ
8020 RETURN
8025 LET OW=W
8030 PRINT AT 2Ø,Ø;"NEW WARP FACTOR?"
8035 INPUT W
8040 IF W>WMAX THEN GOTO 8Ø7Ø
8045 PRINT AT 13,5;W;AT 2Ø,Ø;EØ
8050 IF OW=Ø AND DOCKED THEN GOSUB 38ØØ
8060 RETURN
8070 PRINT AT 2Ø,Ø;"THE ENGINES WONT TAKE THAT CAP""N"
8075 GOSUB 37ØØ
8080 GOTO 8Ø3Ø
8100 REM *SHIELD*
8105 IF SØ="OUT " THEN GOTO 817Ø      (nb OUT is inverse)
8110 LET SH=NOT SH
8130 LET SØ="DOWN"
8140 IF SH THEN LET SØ="UP"
8150 PRINT AT 12,28;SØ
8160 RETURN
8170 PRINT AT 2Ø,Ø;"SHIELD IS OUT OF ACTION"
8180 GOSUB 37ØØ
8190 RETURN
8200 REM *SENSORS DETECT KLINGON
8205 IF  DK<>2 THEN GOTO 823Ø
8210 LET CØ="ORANGE"
8220 PRINT AT 12,1Ø;CØ
8230 LET TV=KV+4
8240 IF TV>8 THEN LET TV=TV-8
8250 PRINT AT 17,Ø;NK;" UFOS, ";DK;" LIGHT YEARS,VECTOR ";TV
8260 RETURN
8500 REM **SENSORS**
8510 IF RØ<>"OUT"  THEN GOTO 854Ø   (OUT is inverse video)
 8520 PRINT AT 2Ø,Ø;"SENSORS OUT OF ACTION"
8525 GOSUB 37ØØ
8530 RETURN
8540 LET SS=NOT SS
8550 LET RØ="OFF"
8560 IF SS THEN LET RØ="ON"
8570 PRINT AT 13,29;RØ;AT 17,Ø;EØ
8580 IF SS THEN PRINT AT 17,Ø;"NO KLINGONS IN SENSOR RANGE"
8590 RETURN
```


MICROMART

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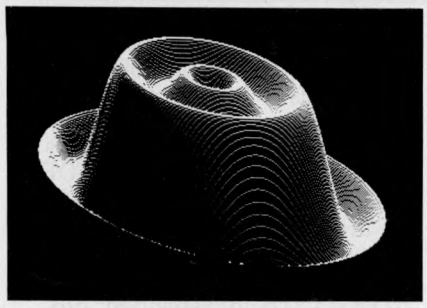

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PROGRAMS

```
8600 REM *NEXT STARBASE*
8620 PRINT AT 2Ø,Ø;"NEAREST STARBASE ";BD;" LIGHT"
8625 PRINT "YEARS AT VECTOR ";BV
8630 GOSUB 37ØØ
8650 RETURN
8800  REM*CHANGE VECTOR*
8810 PRINT AT 2Ø,Ø;"NEW VECTOR?"
8820 INPUT V
8825 LET V=INT V
8830 IF V>Ø AND V<9 THEN GOTO 885Ø
8840 GOTO 882Ø
8850 PRINT AT 13,16;V;AT 2Ø,Ø;E$
8860 RETURN
9000 REM **KLINGON ATTACK
9010 LET C$="RED"    (inverse video)
9020 PRINT AT 12,1Ø;C$
9025 IF DOCKED THEN GOSUB 5Ø8Ø
9030 LET K=S+21
9040 FOR I=1 TO 5
9050 POKE K,147
9060 POKE K+1,146
9070 POKE K,128
9080 POKE K+1,128
9090 LET K=K+64
9100 NEXT I
9110 FOR I=1 TO NK*2
9120 LET UU=USR 16514
9130 FOR J=1 TO 2
9140 NEXT J
9150 NEXT I
9160 GOSUB 92ØØ
9170 RETURN
9200 REM*CALCULATE DAMAGE*
9210 LET D=D+NK*(20+20*(NOT SH))
9215 PRINT AT 15,7;D
9220 IF D>=4ØØ THEN GOTO 93ØØ
9230 LET TV=INT (D/1ØØ)
9240 GOTO 97ØØ-1ØØ*TV
9300 LET WE=Ø
9310 LET W=Ø
9320 PRINT AT 13,5;W;AT 16,Ø;"WARP ENGINES OUT"   (OUT is inverse)
9400 LET P=Ø
9410 LET P$="OUT"     (inverse)
9420 PRINT AT 14,8; P$
9500 LET S$="OUT"   (inverse)
9510 LET SH=Ø
9520 PRINT AT 12,28;S$
9600 LET SS=Ø
9610 LET R$="OUT"    (inverse)
9620 PRINT AT 13,29;R$;AT 17,Ø;E$
9700 RETURN
9750 REM *NEXT PAGE*
```


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PROGRAMS

```
9760 PRINT AT 21,Ø;"PRESS ANY KEY TO CONTINUE."  (inverse)
9770 IF INKEY$="" THEN GOTO 977Ø
9780 CLS
9790 RETURN
9800 REM *INSTRUCTIONS*
9802 CLS
9804 PRINT "YOU ARE IN COMMAND OF STARSHIP"
9806 PRINT "ENTERPRISE. YOUR MISSION IS TO"
9808 PRINT "DESTROY KLINGON BATTLE CRUISERS"
9810 PRINT "IN THIS QUADRANT OF THE GALAXY."
9812 PRINT "YOU ARE ARMED WITH PHASERS AND"
9814 PRINT "PHOTON TORPEDOS. TORPEDOS CAN"
9816 PRINT "ONLY BE FIRED IF YOUR SHIELD IS"
9818 PRINT "DOWN, AND YOU HAVE A LIMITED"
9820 PRINT "SUPPLY, BUT THEY NEVER MISS."
9822 PRINT "PHASERS ARE FIRED BY YOU, AND"
9824 PRINT "SOMETIMES MISS.THEY USE 50 UNITS"
9826 PRINT "OF ENERGY PER SHOT. IF YOU RUN"
9828 PRINT "OUT OF ENERGY THE MISSION ENDS."
9830 PRINT "ENERGY DRAINS ARE LIFE SUPPORT"
9832 PRINT"(CANNOT BE SWITCHED OFF), WARP"
9834 PRINT "DRIVE (HIGH SPEED USES MORE"
9836 PRINT "ENERGY), SENSORS (IF ON), SHIELD"
9838 PRINT "(IF ON), AND DAMAGE REPAIR."
9840 PRINT "DAMAGE IS SUSTAINED AS A RESULT"
9842 PRINT "OF KLINGON ATTACK AND IS WORSE"
9844 PRINT "IF UNSHIELDED.IF MORE THAN 100"
9846 GOSUB 975Ø
9848 PRINT "UNITS, SENSORS ARE LOST;>200 -"
9850 PRINT "SHIELD IS LOST; >300 - PHASERS"
9852 PRINT "ARE LOST;>400 - WARP DRIVE LOST."
9854 PRINT "FUNCTIONS ARE NOT RESTORED UNTIL"
9856 PRINT "DAMAGE IS <10 UNITS, OR UNLESS"
9858 PRINT "YOU REQUEST EMERGENCY REPAIR"
9860 PRINT "(USES A LOT OF ENERGY), OR UNTIL"
9862 PRINT "YOU DOCK AT A STARBASE. EACH"
9864 PRINT "STARBASE CAN REFUEL ONLY ONE"
9866 PRINT "SHIP, SO YOU WILL NEED TO CALL"
9868 PRINT "AT SEVERAL DURING A LONG"
9870 PRINT "MISSION, BUT DO NOT LEAD THE"
9872 PRINT "KLINGONS THERE OR THE BASE WILL"
9874 PRINT "BE DESTROYED."
9876 PRINT "COMMANDS ARE GIVEN BY PRESSING"
9878 PRINT "A CERTAIN KEY (YOU MAY HAVE TO"
9880 PRINT "WAIT A FEW SECONDS BEFORE THE"
9882 PRINT "SHIPS COMPUTER OBEYS)."
9884 PRINT "OPTIONS ARE :-"
9886 GOSUB 975Ø
9888 PRINT "S  CHANGE SHIELD STATUS"
9890 PRINT "Z  CHANGE SENSOR STATUS"
9892 PRINT "W  CHANGE WARP FACTOR (Ø TO 9)"
9894 PRINT "V  CHANGE VECTOR(DIRECTION 1-8)"
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PROGRAMS

```
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9890 PRINT "Z  CHANGE SENSOR STATUS"
9892 PRINT "W  CHANGE WARP FACTOR (0 TO 9)"
9894 PRINT "V  CHANGE VECTOR(DIRECTION 1-8)"
9896 PRINT "E  DO EMERGENCY REPAIRS"
9898 PRINT "T  FIRE PHOTON TORPEDOS"
9896 PRINT "E  DO EMERGENCY REPAIRS"
9898 PRINT "T  FIRE PHOTON TORPEDOS"
9900 PRINT "P  ARM PHASERS. YOU THEN FIRE BY"
9902 PRINT "   PRESSING ANY KEY (HOLD DOWN"
9904 PRINT "   FOR CONTINUOUS FIRE."
9906 PRINT "B  GIVES DISTANCE AND DIRECTION"
9908 PRINT "   OF NEXT STARBASE."
9910 PRINT "VECTORS ARE :-"
9912 PRINT "     1"
9914 PRINT "    8 2"
9916 PRINT "   7   3"
9918 PRINT "    6 4"
9920 PRINT "     5"
9922 PRINT "AT WARP 8 OR 9 YOU CAN OUTRUN"
9924 PRINT "KLINGONS FROM THE OPPOSITE"
9926 PRINT "DIRECTION. EG. IF  THEY COME FROM"
9928 PRINT "VECTOR 2, YOU MUST TAKE VECTOR 6"
9930 GOSUB 9750
9932 PRINT "THE DISPLAY SHOWS THE MAIN"
9934 PRINT "SCREEN AND INSTRUMENT PANEL OF"
9936 PRINT "THE ENTERPRISE. YOU MUST KEEP"
9938 PRINT "ALERT FOR ATTACKS BY KLINGONS"
9940 PRINT "(WHO LOOK LIKE <>) AND TRY TO"
9942 PRINT" CONSERVE ENERGY SO AS TO REACH"
9944 PRINT "THE NEXT STARBASE."
9946 PRINT "IF SENSORS ARE ON, YOU GET A"
9948 PRINT "WARNING OF KLINGONS NEARBY"
9950 PRINT
9952 PRINT
9954 PRINT "GOOD LUCK CAPTAIN."
9956 GOSUB 9750
9958 RETURN
```

PET Knockout

by Paul Bradshaw

This is an application program which will organise and control a knockout tournament for any number of players. The author tells me that it was written for an Egg-Jarping contest at Easter but readers will have to use their imagination on what exactly this involves, as no further explanation was offered!

Players are entered either through the keyboard or from a previous record on tape. The ability to save competitors' names on tape is useful if several tournaments are being held using the same players. A printed list of competitors can also be obtained.

When all the players' names have been entered, the computer will allocate matches at random. The user is asked to

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PROGRAMS

input all the results and the winner is eventually decided.

This program will run on any PET—it was developed on the 3.0 ROM. Some POKEs will have to be added to the tape file routines for 'old ROM' PETs and these are detailed in the latest manual.

Listing courtesy of Mr S Warner.

```
100 A=RND(0)
110 PRINT"■"TAB(16)"KNOCKOUT
120 PRINTTAB(16)"─────────"
130 PRINT"■PLEASE CHOOSE YOUR OPTION:
140 PRINT"─────────────────────"
150 PRINT"■■1. INPUT COMPETITORS FROM KEYBOARD
160 PRINT"■2. INPUT COMPETITORS FROM CASSETTE
170 PRINT"■3. STORE COMPETITORS ON CASSETTE
180 PRINT"■4. PRINT OUT LIST OF COMPETITORS
190 PRINT"■5. CARRY OUT KNOCKOUT COMPETITION
200 PRINT"■6. EXIT TO BASIC
210 PRINT"■■WHICH ONE DO YOU WANT?
220 GETH$:H=VAL(H$):IFH<1ORH>6THEN220
230 IFH=6THENPRINT"■";:END
240 ONHGOSUB260,390,550,660,810
250 GOTO110
260 REM *** ENTER COMPETITORS FROM KEYBOARD ***
270 CLR
280 PRINT"■HOW MANY COMPETITORS? ";
290 GOSUB1420:NC=A
300 IFNC<2THEN280
310 DIMC$(NC),X$(NC),Y$(NC/2+1),B$(SQR(NC)+1),F(NC)
320 PRINT"■";
330 FORJ=1TONC
340 PRINT"■TYPE NAME OF COMPETITOR"J":";
350 GOSUB1420:C$(J)=A$
360 FORK=1TOJ-1:IFC$(K)<>A$THENNEXT
370 IFK<JTHENPRINT"■SAME NAME ENTERED TWICE!":GOTO340
380 NEXTJ:GOTO110
390 REM *** INPUT COMPETITORS FROM CASSETTE ***
400 GOSUB1460
410 PRINT"■■TYPE FILE NAME OR * TO USE
420 PRINT"■FIRST FILE FOUND: ";:GOSUB1420
430 IFLEN(A$)>10THENPRINT"■MAXIMUM LENGTH
    IS 10 CHARACTERS!■":GOTO410
440 F$="KC:"+CHR$(1):IFA$<>"*"THENF$=F$+A$
450 PRINT:OPEN1,1,0,F$
460 PRINT"■THE FILE HAS BEEN FOUND.
470 INPUT#1,NC:CLOSE1
480 POKE16,INT(NC/256):POKE15,NC-256*PEEK(16)
490 CLR
500 NC=PEEK(15)+256*PEEK(16)
510 DIMC$(NC),X$(NC),Y$(NC/2+1),B$(SQR(NC)+1),F(NC)
520 OPEN1
530 FORJ=1TONC:INPUT#1,C$(J):NEXT
540 CLOSE1:GOTO110
550 REM *** STORE COMPETITORS ON CASSETTE ***
560 IFNC=0THENRETURN
570 GOSUB1460
580 PRINT"■■TYPE FILE NAME: ";:GOSUB1420
590 IFLEN(A$)>10THENPRINT"■MAXIMUM LENGTH,
    IS 10 CHARACTERS!■":GOTO580
600 F$="KC:"+CHR$(1)+A$
610 PRINT:OPEN1,1,1,F$
620 PRINT#1,NC
630 CLOSE1:OPEN1,1,1
630 CLOSE1:OPEN1,1,1
640 FORJ=1TONC:PRINT#1,C$(J):NEXT
```


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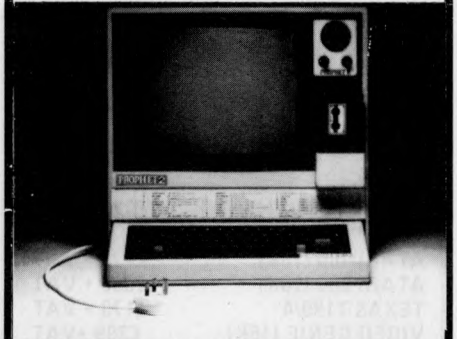

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PROGRAMS

```
650 CLOSE1:RETURN
660 REM *** PRINT LIST OF COMPETITORS ***
670 IFNC=0THENRETURN
680 PRINT"■PRESS 'SPACE' TO CONTINUE AFTER EACH
690 PRINT"■SCREENFUL OF NAMES.
700 PRINT"■■PRESS 'SPACE' FOR LISTING...
710 GETH$:IFH$<>" "THEN710
720 PRINT"■";
730 FORJ=1TONC
740 PRINT"■"J":"TAB(6)C$(J)
750 IFJ/11>INT(J/11)THEN770
760 GETH$:IFH$<>" "THEN760
770 NEXT
780 PRINT"■■PRESS 'SPACE' TO CONTINUE...
790 GETH$:IFH$<>" "THEN790
800 RETURN
810 REM *** CARRY OUT COMPETITION ***
820 IFNC=0THENRETURN
830 PRINT"■WHEN THE MATCHES ARE BEING PRINTED OUT,
840 PRINT"■PRESS 'SPACE' TO CONTINUE AFTER EACH
850 PRINT"■SCREENFUL OF INFORMATION.
860 PRINT"■■WHEN ENTERING THE WINNERS OF EACH MATCH,
870 PRINT"PRESS ■1■ OR ■2■ TO INDICATE WHICH
880 PRINT"■COMPETITOR WON.
890 PRINT"■■PRESS 'SPACE' TO CONTINUE...
900 GETH$:IFH$<>" "THEN900
910 PRINT"■"
920 BP=0
930 FORJ=1TONC:X$(J)=C$(J):NEXT
940 N=NC:B=0:R=1
950 FORJ=1TON:P(J)=0:NEXT:B=0
960 PRINT"■ROUND"R"MATCHES";:P=POS(0):PRINT
970 FORJ=1TOP:PRINT"─";:NEXT:PRINT
980 IFN/2=INT(N/2)THEN1040
990 B=INT(RND(1)*N)+1:IFBP=0THEN1020
1000 FORJ=0TOBP-1:IFB$(J)=X$(B)THEN990
1010 NEXT
1020 B$=X$(B):B$(BP)=B$:BP=BP+1
1030 P(B)=-1
1040 FORJ=1TON/2
1050 X=INT(RND(1)*N)+1:IFP(X)<>0THEN1050
1060 Y=INT(RND(1)*N)+1:IFX=YORP(Y)<>0THEN1060
1070 P(X)=-1:P(Y)=-1
1080 IFX<YTHENP(X)=Y
1090 IFY<XTHENP(Y)=X
1100 NEXT
1110 CN=0:P=1:FORJ=1TON/2
1120 IFP(P)=-1THENP=P+1:GOTO1120
1130 X$=X$(P):Y$=X$(P(P)):P=P+1
1140 PRINT"■"TAB(16-LEN(X$))X$"  ■VERSUS■  "Y$:CN=CN+1
1150 IFCN/10>INT(CN/10)THEN1170
1160 GETH$:IFH$<>" "THEN1160
1170 NEXT
1180 BB$=B$+" HAS A BYE"
1190 IFB>0THENPRINT"■■"TAB((40-LEN(BB$))/2+1)BB$
1200 PRINTTAB(6)"■■PRESS 'SPACE' TO CONTINUE...
1210 GETH$:IFH$<>" "THEN1210
1220 PRINT"■ENTER WINNERS OF ROUND"R;:P=POS(0)-1
1230 PRINT:FORJ=1TOP:PRINT"─";:NEXT
1240 PRINT
1250 P=1:FORJ=1TON/2
1260 IFP(P)=-1THENP=P+1:GOTO1260
1270 X$=X$(P):Y$=X$(P(P))
```


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```
1280 PRINT"■■1■ "X$" OR ■2■ "Y$TAB(35)
1290 GETH$:IFH$<>"1"ANDH$<>"2"THEN1290
1300 PRINTH$
1310 IFH$="1"THENY$(J)=X$(P)
1320 IFH$="2"THENY$(J)=X$(P(P))
1330 P=P+1:NEXT
1340 IFB>0THENY$(J)=B$
1350 N=INT(N/2+.5)
1360 FORJ=1TON:X$(J)=Y$(J):NEXT
1370 IFN>1THENR=R+1:GOTO950
1380 PRINT"■THE WINNER IS ■"X$(1)
1390 PRINT"■■PRESS 'SPACE' TO CONTINUE...
1400 GETH$:IFH$<>" "THEN1400
1410 RETURN
1420 REM *** INPUT SUBROUTINE ***
1430 OPEN1,0:INPUT#1,A$:PRINT:CLOSE1
1440 A=VAL(A$)
1450 RETURN
1460 REM *** CASSETTE POSITIONING ROUTINE ***
1470 PRINT"■INSERT AND CORRECTLY POSITION CASSETTE
1480 PRINT"■TO BE USED, THEN PRESS ANY KEY.
1490 GETH$:IFH$=""THEN1490
1500 IFPEEK(59411)=61THENRETURN
1510 PRINT"■PRESS 'STOP' ON THE CASSETTE DECK.
1520 IFPEEK(59411)<61THEN1520
1530 RETURN
READY.
```

PET Trains

by Jeff Aughton

Trains is great fun to play, and not just for children. A grid on the screen defines a track on which run an increasing number of trains. The player's job is to control these little trains and stop them hitting either each other or the buffers. Just to make things interesting, random closures of junctions have been thrown in as well. It is by no means an easy game to play, and it's unlikely that readers who key in this game will ever last longer than four minutes or so. As a program it is easy and clear to follow. It was tested on a 3022 PET.

```
100 DIMA$(12),P%(18),T%(8,3)
150 GOSUB9000
160 F=0:M=1:U=1:X=160:Y=163:Z=32768
200 D$="■■■■■■■■■■■■■■■■■■■■■■■■■■"
210 A$(0)=" ■■■■■■■■ ■■■■■■■■ "
220 A$(1)="■■■ ■■■■■■■■■ "
230 A$(2)="■■■■■■■ ■■■■■■ "
240 A$(3)="■■■■■■ ■■■ ■■"
250 A$(4)="■■■ ■■■■ ■■"
260 A$(5)="":A$(7)=""
270 A$(6)=" ■■ ■■■■■■■■■■■■■ ■■ "
280 A$(8)=" ■■■■■■■■ ■"
290 A$(9)=" ■■■■■■ ■■■■■"
300 A$(10)="■■■ ■■■ ■■■■■■"
310 A$(11)="■■■ ■■■■■ ■■"
320 A$(12)="■■■ ■■■■ ■■■■■ ■■"
330 Z$="■":FORI=1TO39:Z$=Z$+" "
340 NEXT:Z$=Z$+"■"
350 IFV<.2THENA$(2)="■■ ■ ■■■■ ■■■■ ■ "
360 IFV<.4THENA$(8)=" ■■ ■■■■■ "
400 FORI=1TO8:T%(I,1)=203:T%(I,2)=-1
410 T%(I,3)=X:NEXT
500 PRINT"■■":FORI=1TO3
510 GOSUB7000:FORJ=1TO6
```


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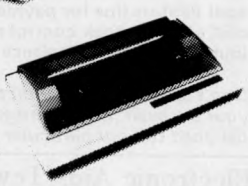

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PROGRAMS

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530 GOSUB7000
540 POKE32849,233:POKE32885,223
550 POKE33689,95:POKE33725,105
560 FORI=0TO10:READJ:POKEZ+J,96:NEXT
600 FORI=65TO82:K$=CHR$(I)
610 GOSUB7200:IFP%(A)=5THENNEXT
620 IFRND(1)<.5THENP%(A)=12-P%(A)
630 PRINT"]";K$;"▚█";A$(P%(A)):NEXT
640 PRINT"▚▚▚▚▚▚▚▶▚  ▀]_▚H ▚█▔"
650 B=TI
1000 T=TI
1010 GETK$:IFK$<"A"ORK$>"R"THEN2000
1020 GOSUB7200:P%(A)=12-P%(A)
1030 PRINTA$(P%(A))
2000 D=T%(U,2):P=Z+T%(U,1):K=T%(U,3)
2010 IFK=XTHEN2050
2020 IFK=YORK=170ORK=32THEN6000
2040 D=40/D:IFKAND32THEND=-D
2050 T%(U,2)=D:POKEP,T%(U,3)
2060 IFPEEK(P+D)=96THENT%(U,2)=SGN((UAND1)
     -.5)*40/D:GOTO2000
2070 P=P+D:T%(U,3)=PEEK(P):POKEP,Y
2080 T%(U,1)=T%(U,1)+D
2090 FORI=1TO180/M-7*M:NEXT
2100 U=U+1:IFU>MTHENU=1
2110 IFTI-T<800*(1+RND(1))THEN1010
2115 IFTI-B>14400THEN6300
2120 IFFTHEN5200
2130 IFRND(1)<VTHENGOSUB5000
2140 M=M-(M<N):GOTO1000
4000 FORI=0TO12:PRINT"]";TAB(I)K$
4010 FORJ=1TO110:NEXTJ,I
4020 PRINT:RETURN
4500 GETK$:IFK$<>" "THEN4500
4510 PRINT"]";:RETURN
5000 Q=6-5*(RND(1)<.5)+INT(3*RND(1))
5010 K$=CHR$(Q+64):F=1
5020 PRINTZ$;" POINTS AT ";K$;" CLOSING DOWN SOON▚▚"
5030 PRINT"▶▶▶▶▶▶▶▶A▶▶▶▶▶▶▶▶▶B▶▶▶▶▶▶▶▶C"
5040 GOSUB7200:PRINT"]";K$:RETURN
5200 PRINTZ$;:IFF=2THEN5400
5210 A=Q:GOSUB7205:PRINTA$(6)
5220 P%(A)=6:F=2:GOTO1000
5400 F=0:A=Q:P%(A)=0
5410 PRINT"POINTS NOW CLEAR"
5420 GOSUB7205:PRINTA$(0):GOTO1000
6000 B=INT((TI-B)/60)
6010 PRINTZ$;"CRAAAASH!!!!"
6020 S=37:FORI=0TO9:RESTORE:FORJ=1TO9
6030 READC:POKEP+C,S+I:NEXTJ,I
6040 FORI=1TO1000:NEXT
6050 PRINT"]YOU SURVIVED FOR";B;"SECONDS"
6060 PRINT"▚▚YOUR SCORE IS";INT(100*(B/240)↑(1-V));"%"
6070 PRINT"▚▚PLAY AGAIN (Y/N)?"
6080 GETK$:IFK$="N"THENEND
6090 IFK$<>"Y"THEN6080
6100 RESTORE:GOSUB9500:GOTO160
6300 FORI=0TO2000:NEXT
6310 PRINT"]YOU LASTED OVER FOUR MINUTES!!!▚▚"
6320 PRINT"DO BRITISH RAIL KNOW ABOUT YOU ?"
6330 GOTO6070
7000 PRINT"▶█";:FORJ=1TO37
7010 PRINT"▚ ";:NEXT:PRINT:RETURN
```


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PROGRAMS

```
7020 S=36:FORI=0TO9:RESTORE:FORJ=1TO9
7030 READC:POKEP+C,S:NEXTJ
7040 S=79-S:NEXTI
7100 PRINT"■";:FORK=1TO4
7110 PRINT"■ ■          ";:NEXT:RETURN
7200 A=ASC(K$)-64
7205 R=INT(A/5):C=9*(A-5*R)
7210 PRINTLEFT$(I$,2+7*R);SPC(C);
7220 RETURN
8000 DATA -41,-40,-39,1,41,40,39,-1,0
8100 DATA 1,1,5,5,5,0,0,0,5
8110 DATA 2,5,0,5,3,5,4,5,4
8200 DATA 1,1,1,5,5,0,5,0,3
8210 DATA 2,0,0,5,5,5,5,4,4
8300 DATA 1,1,1,5,2,0,0,0,3
8310 DATA 2,0,0,0,3,5,4,4,4,0
8400 DATA 50,59,68,200,360,398
8410 DATA 640,678,970,979,988
9000 PRINT"■■■■■"
9010 K$="     TRAINS":GOSUB4000
9020 K$="     ──────":GOSUB4000:PRINT
9030 K$=" BY J.AUGHTON":GOSUB4000
9040 PRINT"■■■■■ALWAYS PRESS THE SPACE BAR WHENEVER YOU"
9050 PRINT"■ ARE READY TO PROCEED TO THE NEXT PAGE"
9060 GOSUB4500
9310 PRINT"TRY TO CONTROL THE TRAINS(#) AS THEY GO■"
9320 PRINT"ROUND THE SYSTEM . EACH OF THE POINTS■"
9330 PRINT"IS LABELLED WITH A LETTER A-R.YOU CAN■"
9340 PRINT"SWITCH THE POINTS BY PRESSING THE KEY■"
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9390 PRINT"AT IRREGULAR INTERVALS SOME POINTS MAY■"
9400 PRINT"CLOSE FOR A WHILE FOR REPAIRS.KEEP AN■"
9410 PRINT"EYE ON THE TOP OF THE SCREEN FOR DETAILS"
9420 GOSUB4500
9500 PRINT"■■CHOOSE DIFFICULTY LEVEL 1,2 OR 3■■"
9505 PRINT"1=EASY...3=HARD-YOUR CHOICE";
9510 INPUT"■■■.■■■";K$:V=ASC(K$)-48
9520 IFV<1ORV>3THEN9505
9530 FORI=1TO9+18*(V-1):READS:NEXT
9540 FORI=1TO18:READP%(I):NEXT
9550 FORI=0TO18*(3-V):READS:NEXT
9560 N=2+2*V:V=V/7:RETURN
```

POSITRON 9000

Continued from page 134

good in places, obscure in others and occasionally out of date elsewhere. As with much technical documentation, a fairly creative approach should be adopted to its interpretation, although a first-time user would have a bit of trouble dealing with some of the terms which were introduced without much explanation (eg, recursion).

The manuals covered the following major topics : OS-9, Basic09, Pascal, CIS Cobol, the interactive assembler and debugger, the text editor, Stylographic and system programming.

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POSITRON 9000

Continued from previous page

to the restriction of four concurrent processes per memory management unit. Regular *PCW* readers will remember these tests, introduced in February 1981. They include a processor test (actually Basic BM7 above) and two disk access tests which write and read 100 128-byte records to and from the disk, in the first case opening and closing the file after each read/write; in the second using only a single open and close for all writes and reads. These are designed to look at filing system overheads and record locking schemes. Finally the I/O test lists the printable ASCII subset 100 times. The disk tests utilised the winchester disk.

In the event, it was not possible to observe any degradation in performance although equally we were disappointed not to be able to run more than two tasks simultaneously on the review system (with an additional terminal attached).

The timings appear below:

	1 User	2 Users
Processor	19.0	36.4
Disk (single R/W)	67.7	134.4
Disk (100 R/W)	8.4	—
I/O	56.0	102.1

Attempts to get more processes running resulted in a memory full error which is a pity since we wouldn't have minded waiting if the tasks could have been queued.

Conclusions

The Positron 9000 is a flexible, well-built multi-user system that runs a Unix-influenced operating system, OS-9. It has an unconventional but powerful Basic compiler, a Pascal compiler and CIS Cobol. There is a word-processing package and the promise of a record management system, a suite of accounting software and a C compiler. It can take up to 512 kbytes of RAM and 256 kbytes of ROM, has up to 12 RS232 ports, an IEEE-488 bus, floppy and hard disks, and a network.

However, we believe it is based on a faulty design philosophy: in the days of cheap processors, a lot of hardware and software has been made dependent on a single, slow 8-bit processor. The basic system is more expensive than its competitors because it has so much built-in potential for expansion, yet for many applications requiring the extra resources the processor is likely to run out of power. Nevertheless, applications which may not be processor bound and which can exploit the low-cost multi-tasking software, perhaps in the field of process and industrial control, could find the Positron has few real competitors.

END

PERSONAL PEARL

Continued from page 164

would be clumsy to use on a system with small disks — even on a system with ½ Mb disks I couldn't get all the programs on one disk. My review copy was supplied by Pearl Software International (UK) of Poole, the UK importer — the software originates in the USA.

Conclusions

Considered as a data management system Pearl has several advantages. It provides quite straightforward facilities for novice users, and should enable them to design and implement a simple file management system fairly easily. Accessing information in related files is well catered for and much less limited in its scope than in some of Pearl's competitors. The methods of data storage should be quite economical in that Pearl does not need to reserve the maximum permitted field length for every field in a record, and stores only the data which is actually there.

On the other hand, the way the data dictionary which permits these goodies has been implemented means that the user cannot decide, after the data file is set up, to index on extra fields. The selection faciliies are rather restricted, and the one-to-one connection between screen display (for data entry and updating) and data file could be a serious drawback in many applications.

Finally — you either like menu-driven systems or you don't; I prefer them to command-driven systems only if they permit the user who has gained some experience to override the menu options completely, so I think people might get irritated with this aspect of the Pearl user image as they get experienced with the package.

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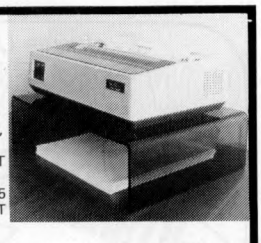

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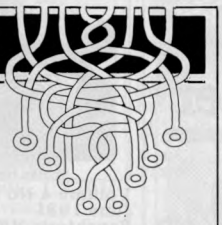
THE ULTIMATE TEST?

Continued from page 141

Finally, the Pascal program published in *Byte* is, in fact, a UCSD Pascal version, utilising FILLCHAR and the function SIZEOF to initialise the Boolean array. Gilbreath regarded as legitimate the use of such implementation-dependent features for his comparisons but we have produced a 'plain' Pascal program to compare with the Fortran and Basic ones. Nevertheless, it is interesting to note that the LSI-11 timing quoted in the articles (for a Terak running UCSD Version II) at 317 sec is 156 per cent slower than our system. Table 1 shows the timings of the programs. The benchmark programs are also listed.

As expected, the UCSD Pascal version runs faster but takes longer to compile (probably due to the need to reference the library more extensively). True to its reputation, the Fortran compiler is fast, but its code does not run quite so quickly as the Pascal versions.

LEISURE LINES



by J J Clessa

We received 160 entries to the July Puzzle. Quite a few got the answer wrong, although again many people complained that it was too easy. There's no satisfying some folks!

The answer was 5000 since $300_3 - 2$ million = 5000_2

The winner, chosen at random, was Mr Stephen Bennington of Clifton, Bedfordshire. Congratulations, Mr B your prize will be on its way forthwith — if not sooner.

Quickie

No answers, no prizes. If it takes four men eight days to dig four holes, how long does it take one man to dig half a hole? The answer is not four days.

Prize puzzle

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Answers, on postcards only, please to: October Prize Puzzle, *PCW*, 62, Oxford Street, London W1A 2HG to arrive not later than 31 October 1982.

BLUDNERS

Readers will remember the article 'Pouring Quarts Into Pint Pots' which we published in June *PCW*. We have to admit that we made rather a dog's dinner of it and, in fact, left the piece out of the contents page altogether. It was, actually, on page 149. Adding insult to injury, the author's name did not appear beneath the title (or anywhere else on the page!) and so we'll apologise here instead to Erwin Schneider for this mistake.

There were also three little slip-ups in the text and these are as follows: At the end of paragraph four the number 195,000 should read 105,000; in the fourth paragraph from the end the text refers to 'altering the value of 1'- the '1' should be 'I' and finally in the program listing (line 330) the first character before the '=' should be a 'k'.

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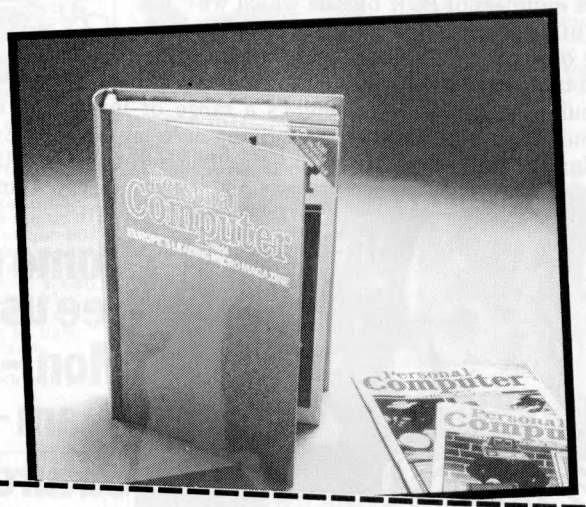

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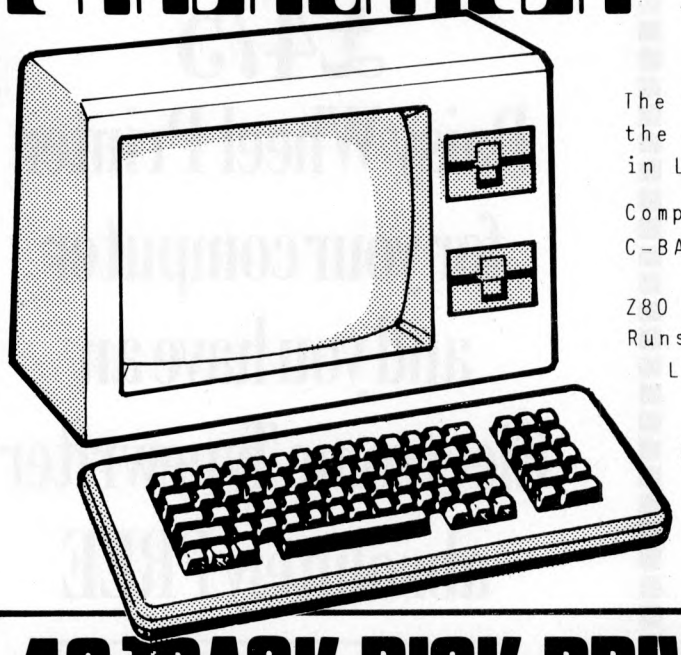

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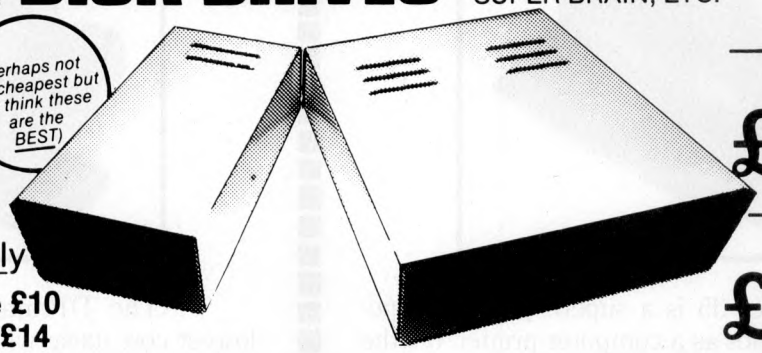

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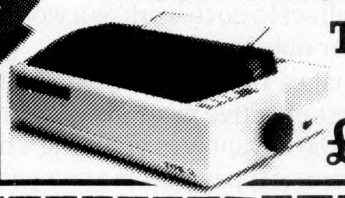

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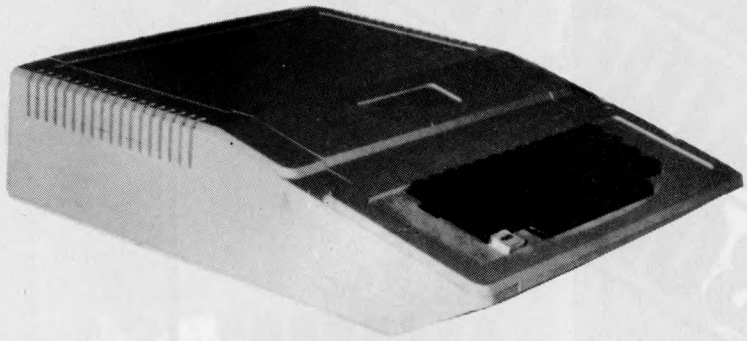

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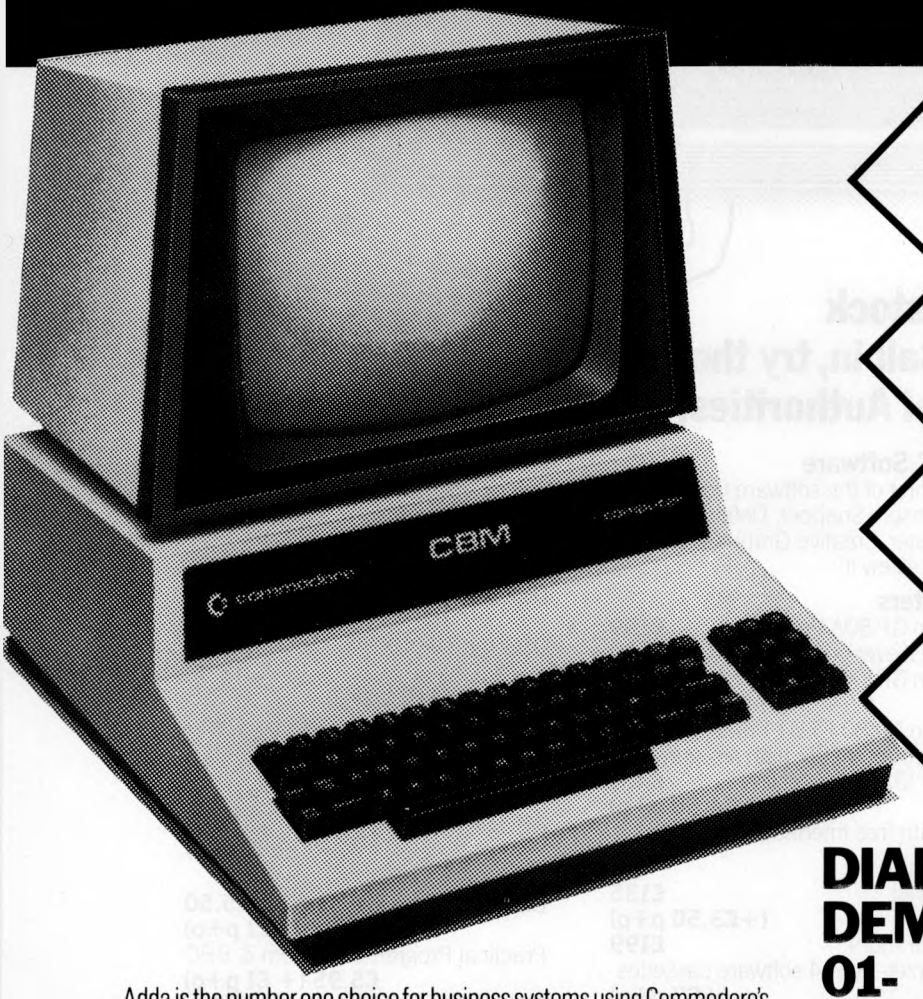

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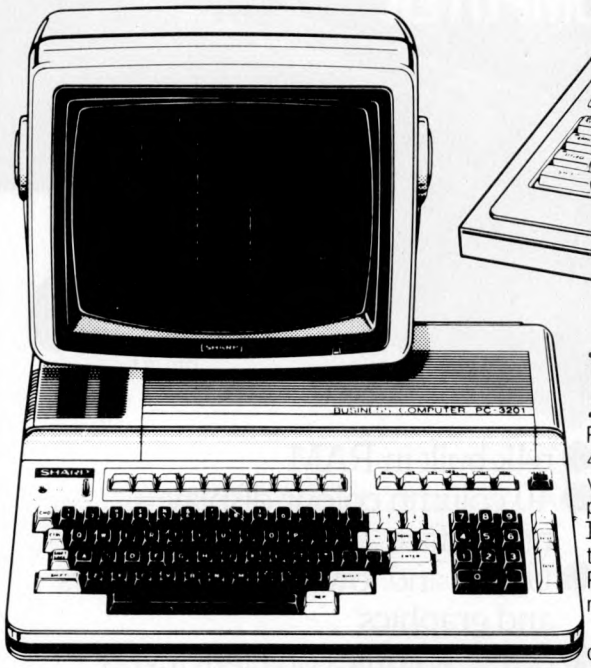

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1–Record	(33)
2–Name	(John Smith [Sir])
3–Addr	(55 Bedford Crt. London.)
4–Age	(40)
5–Sex	(M)
6–C.V.	(5-o levels, 6-a levels)
6–Exp	(3 yrs)
8–Sal	(12,000)
9–Locn	(London/South)
10–Type	(Computer analyst)
11–Sport	(Tennis/golf/riding)
12–Langu	(English/French/German)
13–Pr/emp	(Local government)
14–status	(married/2 children)
15–code[c]	(classified information)

Just one of a thousand selection criteria might take the form:

"Find all persons that are not Esq, who live in London or Surrey or Croydon, in the age range of 30-45 Male, with 6-a levels, experience less than 5 yrs, prepared for work in London or the South, at computer analysis, whose interests are golf or tennis, speaks German or French has worked in Local government and is married. Finally matches our own classified code [grade 5]".
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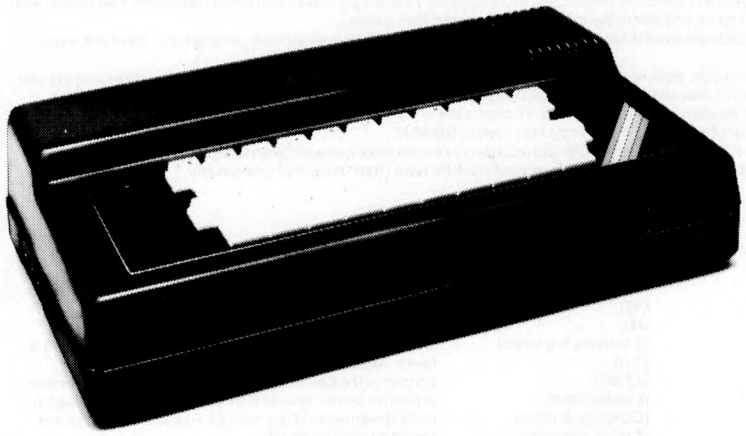

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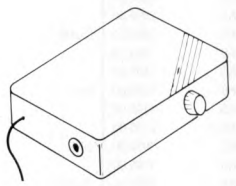

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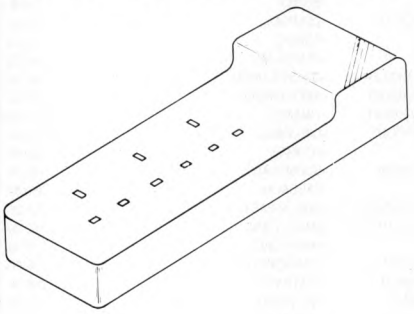

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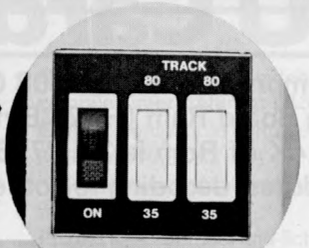

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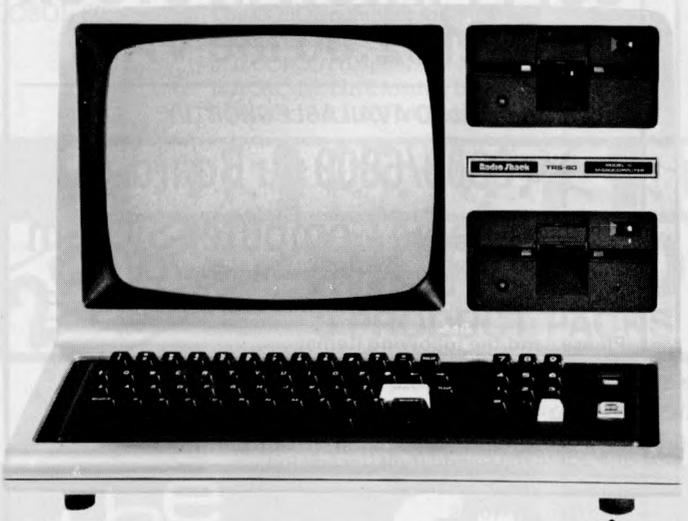

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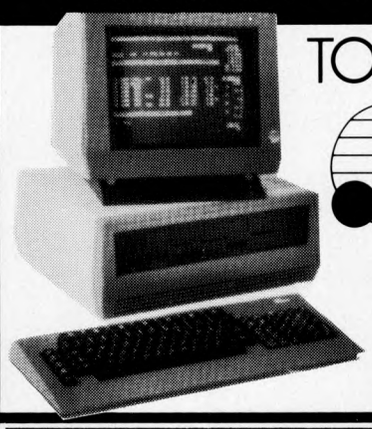

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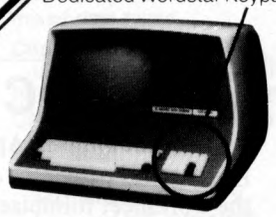

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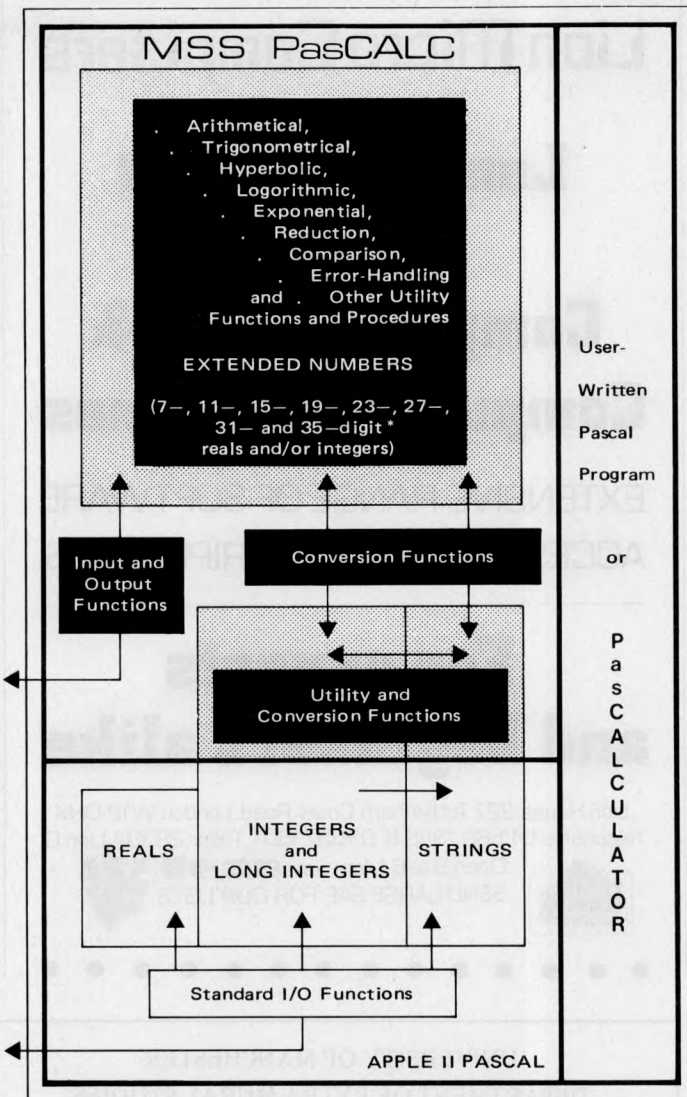

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Extract from Optional Log (Precision Level 15)

```
   Enter command:
Y:=Y+P^(2*LOG[10-(5*E/4)
   0.9364718364577736E0
   Enter command:
A:=0.125E1
   0.1250000000000000E1
   Enter command:
X-SIN[P-EXP[A/(B+Y)]^D]
   -0.1858903639731636E1
   Enter command:
RETAIN
   Retained as command 5
   Enter command:
A:=0.15E1
   0.1500000000000000E1
   Enter command:
COMMAND5
   X-SIN[P-EXP[A/(B+Y)]^D]
   0.8263549275847296E-1
   Enter command:
LISTV
   ----------------
   LIST OF VARIABLES
   ----------------
   A = 0.1500000000000000E1
   B = 1
   D = 5
   E = 0.2718281828459051E1
```

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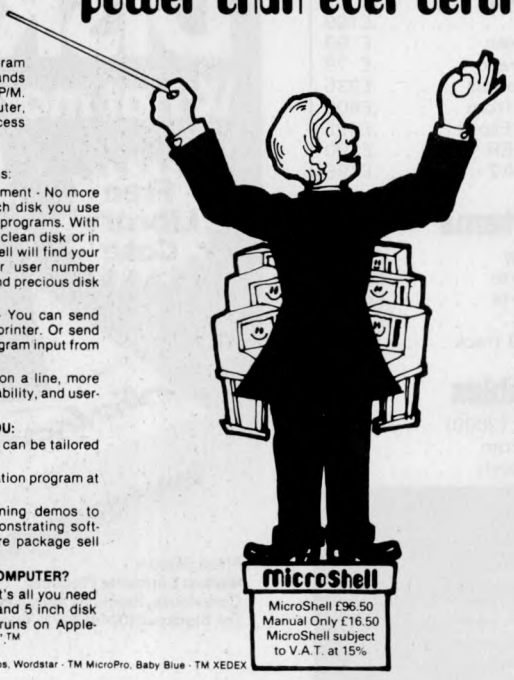

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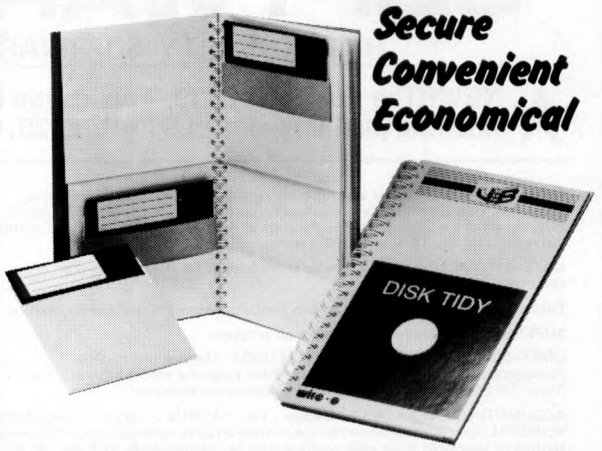

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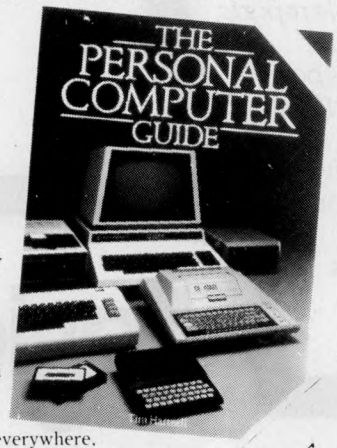

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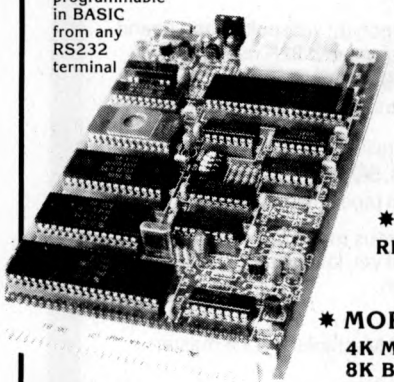

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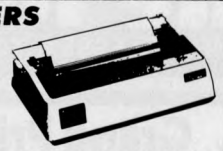

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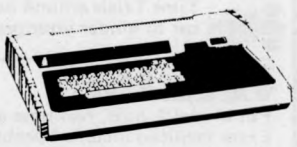

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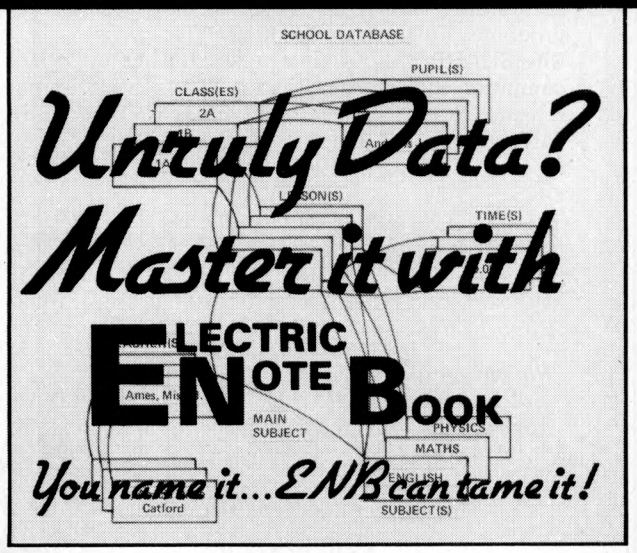

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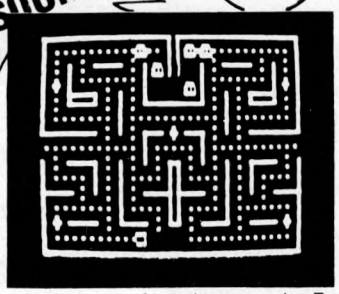

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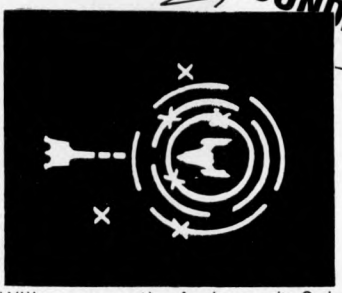

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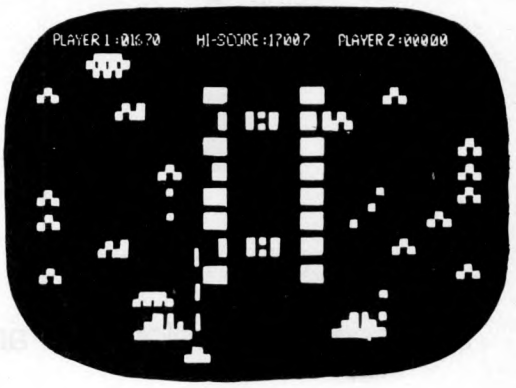

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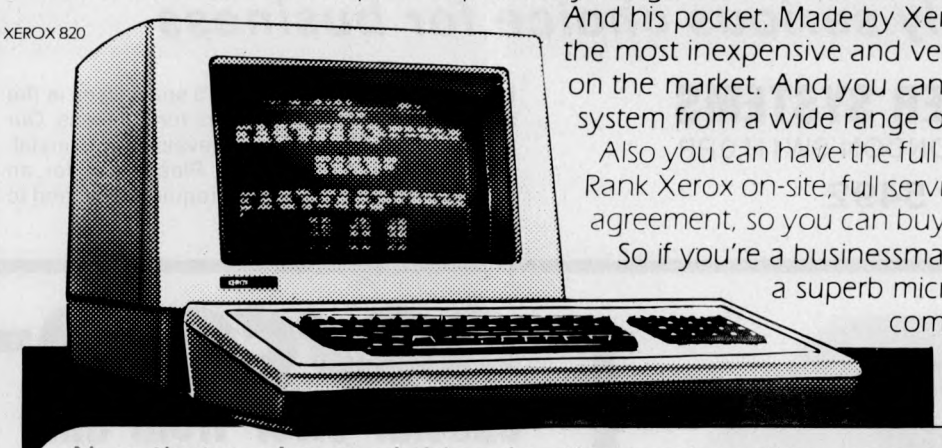

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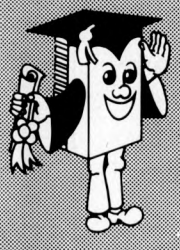

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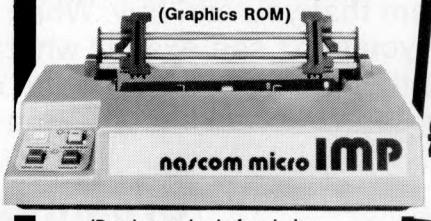

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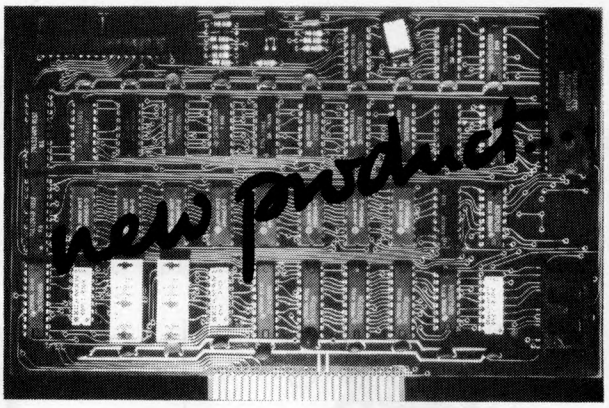

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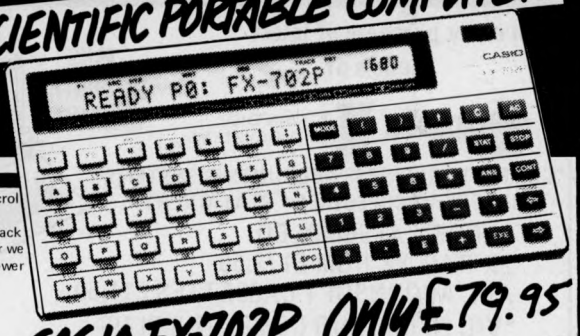

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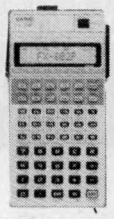

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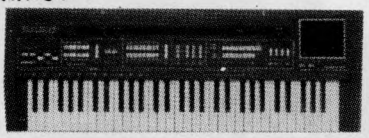

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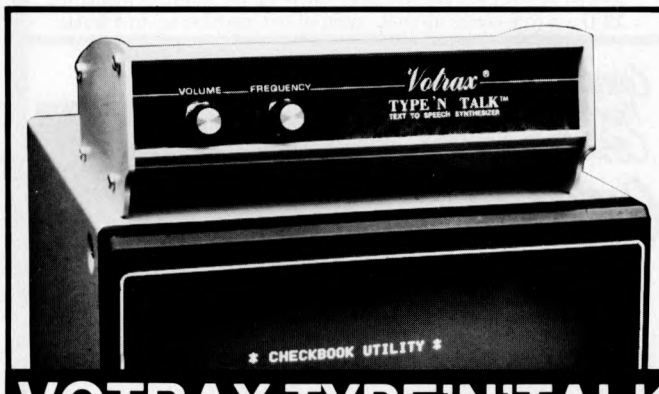

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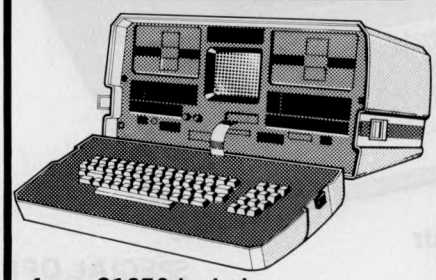

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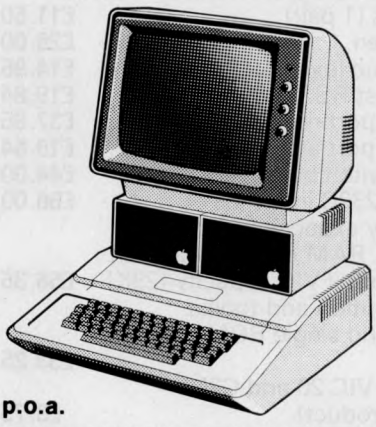

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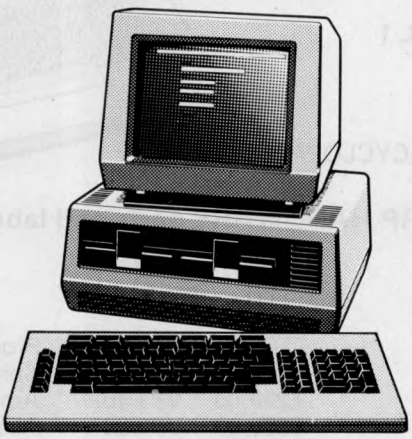

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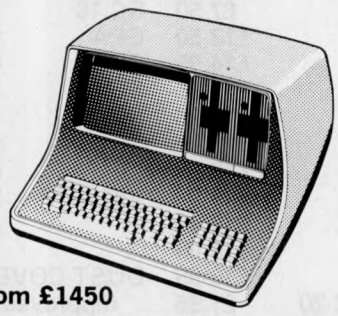

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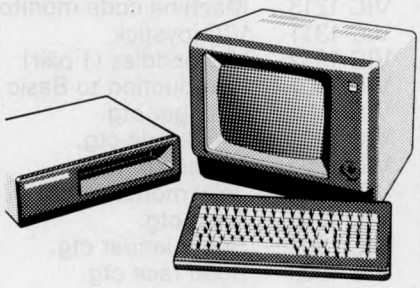

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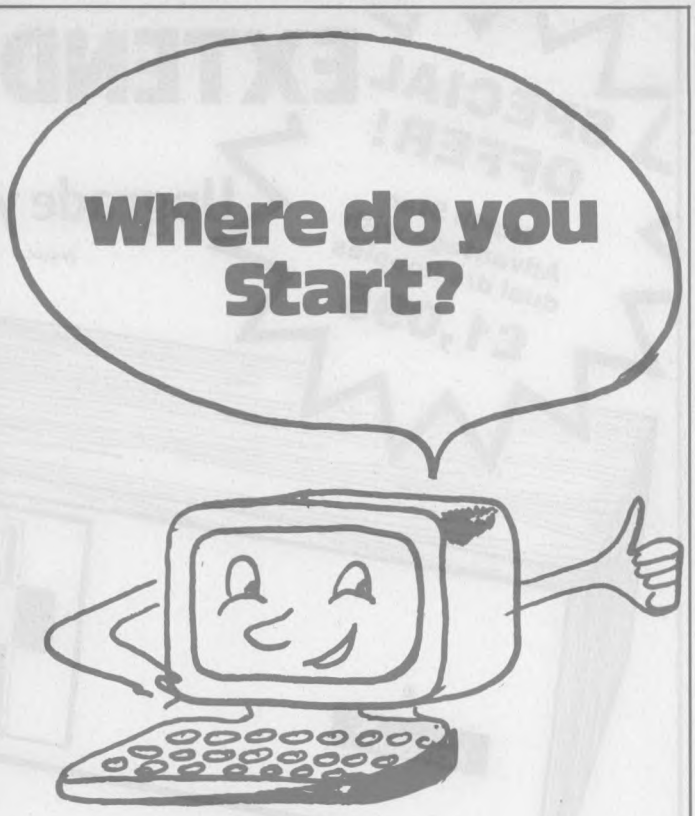

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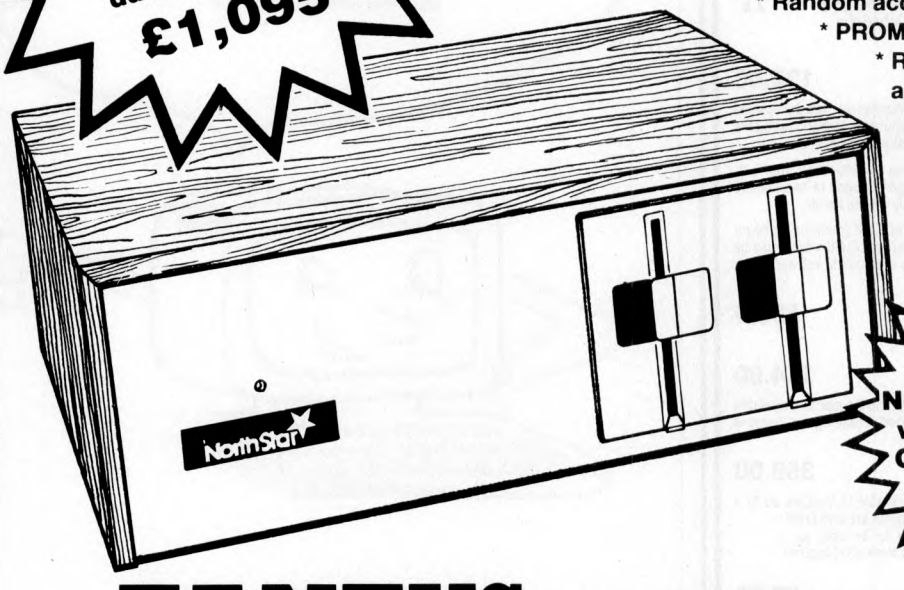

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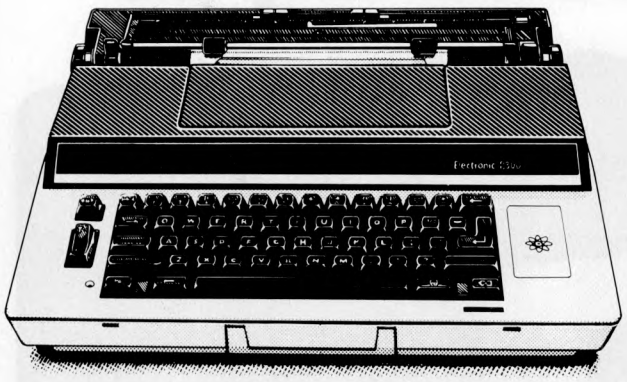

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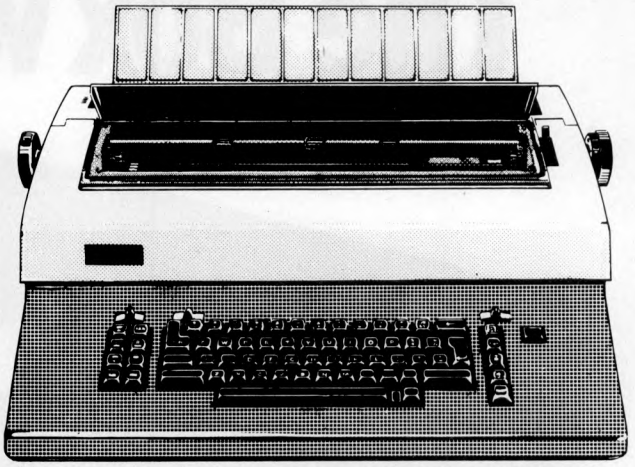

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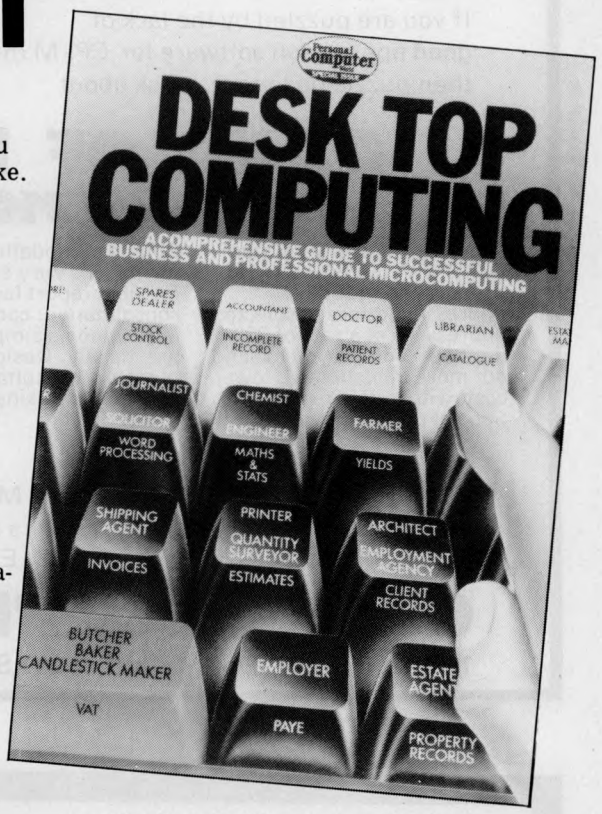

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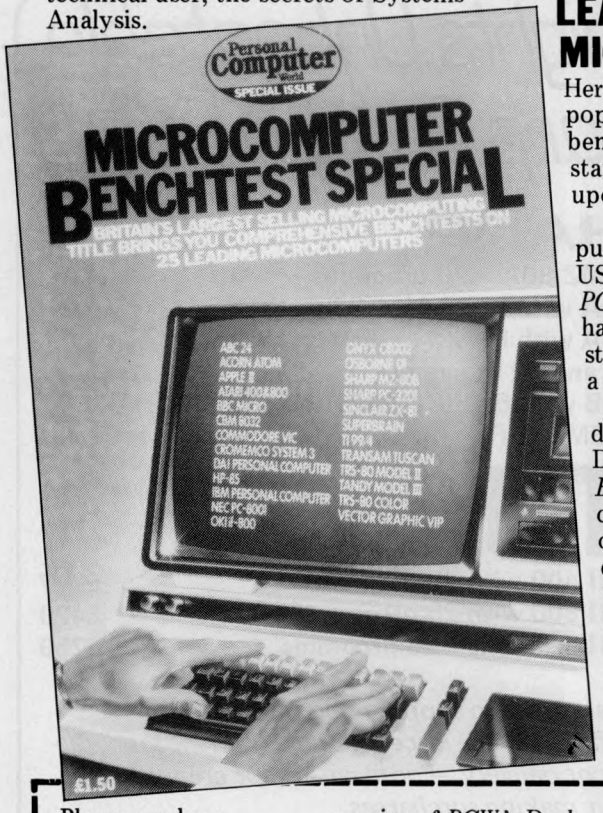

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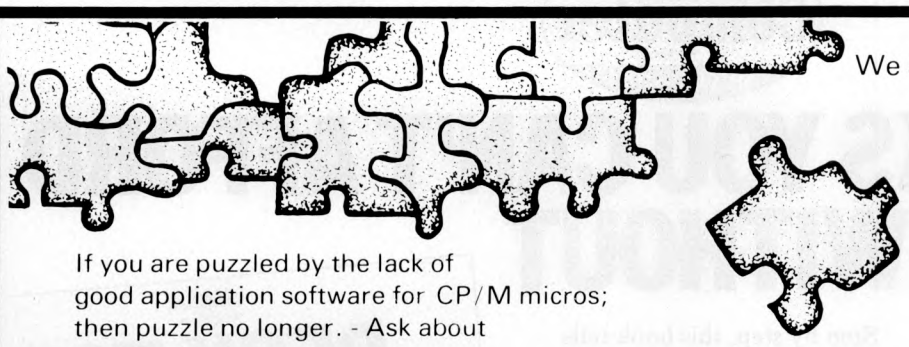

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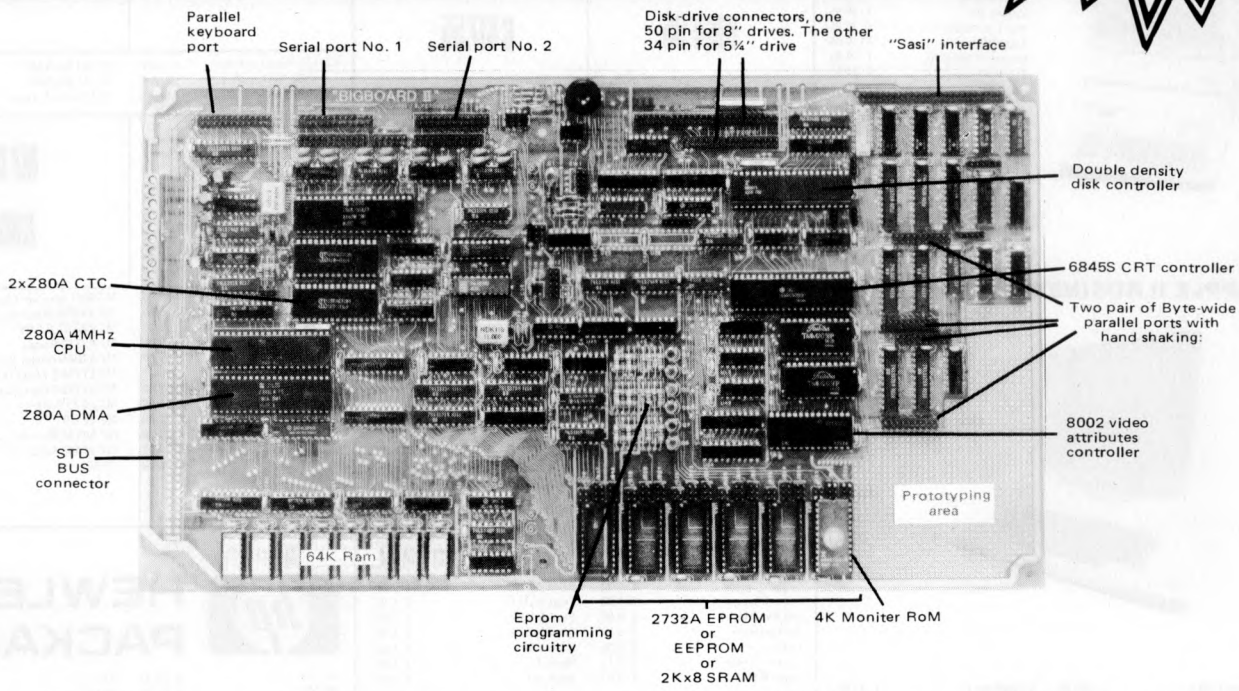

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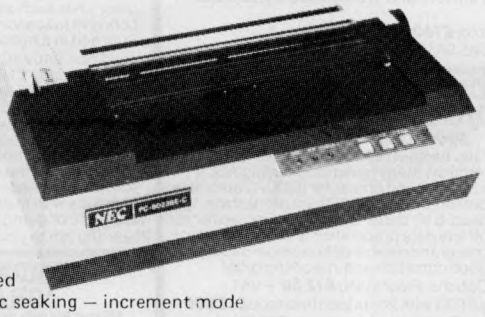

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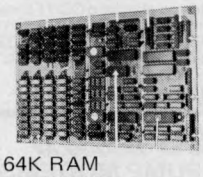

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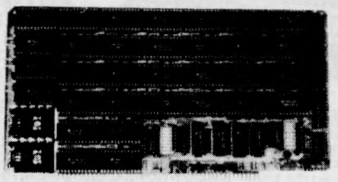

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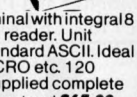

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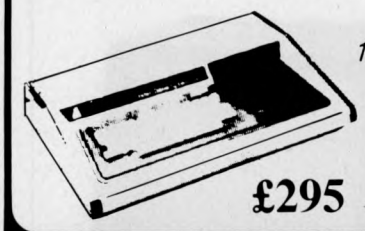

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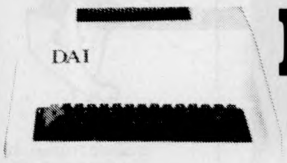

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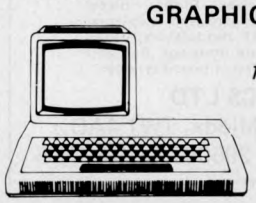

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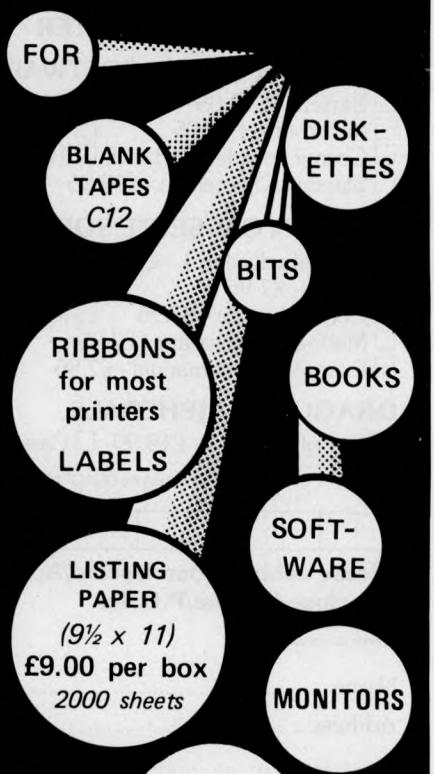

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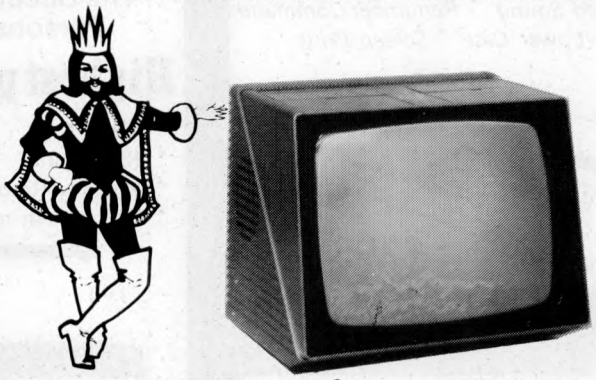

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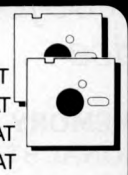

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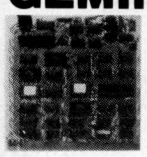

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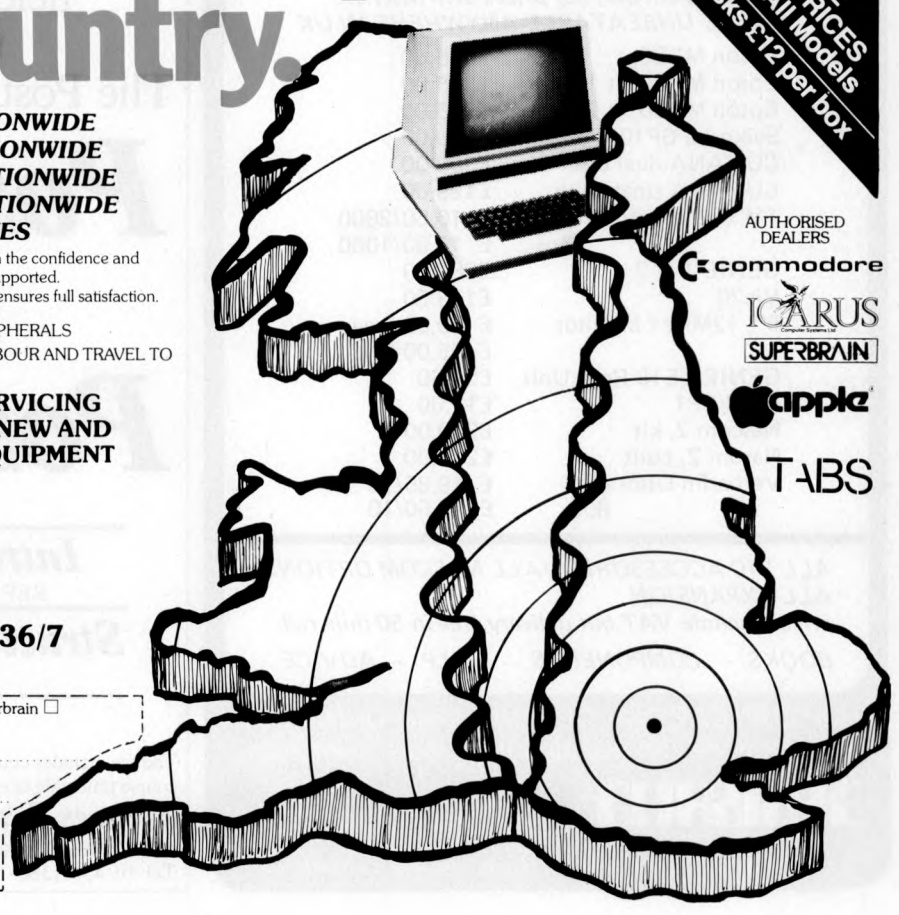

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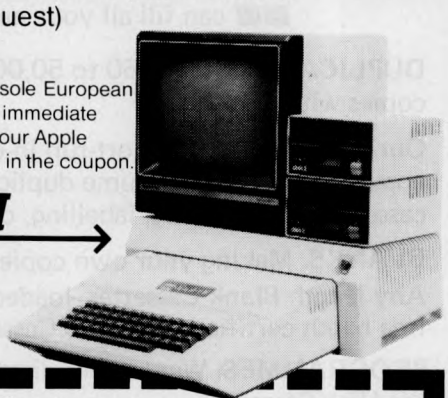

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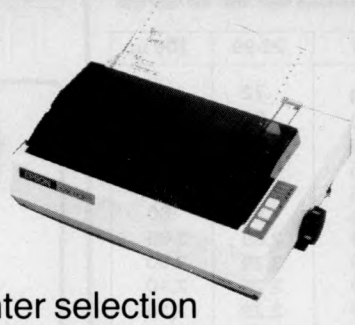

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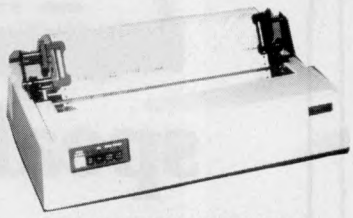

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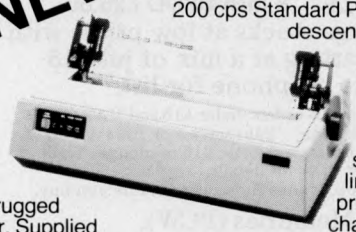

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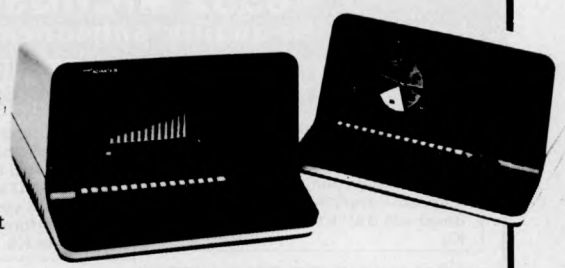

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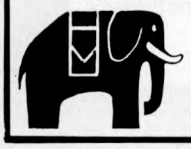

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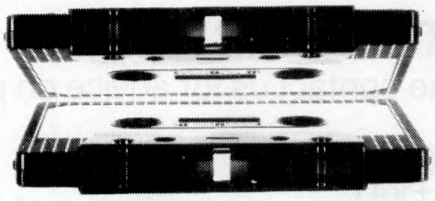

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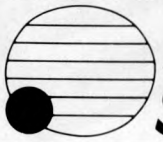

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We hear with immense mirth that ACT's multi-million pound TV advertising campaign, destined to assault our screens soon, has run foul of the Advertising Standards Authority on the grounds of gross sexism. The ad is now being re-shot with 'Squire' Allason, no less, taking the place of the offending scantily-clad female . . . Early morning Radio 4 listeners were treated to an hour of micro wisdom recently when David Tebbutt and Martin 'Voiceless' Banks starred on a phone-in together, answering the eager questions of the listening public. All went well until someone asked what grade 'A' levels are required to study computer science; turns out that both 'Voiceless' and 'Tebbo' are too old to have been through the 'A' level mill and could only advise about taking a clean rag into the exam to wipe the slate off . . . Editor Rodwell has become quite insufferable since he bought himself a massive and totally ostentatious BMW motorcycle. He's taken to going around offering suitable young ladies a 'quick blast up the M4', so far without any of them being silly enough to accept. His enthusiasm was considerably dampened, though, when he tore a muscle trying to heave the megabike onto its centre stand for the first time, to the amusement of Dick 'Poison Pen' Pountain, who rides a Honda . . . In an effort to get this edition on sale at the *PCW* Show, your Editorial and art room teams worked their ****s off and managed to produce an entire issue in just a week and a half . . . The habit of certain publications (not *PCW*) of accepting 'financial remuneration' in exchange for front-cover publicity for whichever machine they're reviewing seems now to be regarded as the norm by some companies in the micro business. A very large manufacturer, who really should know better, recently offered us such a bribe to get his machine onto our cover. And we thought we'd made it quite clear that this approach *never* works with us — in fact our immediate inclination is to drop the machine altogether . . . Have you ever wanted to work for *PCW* You have? You must be mad! No, that's wrong, what we mean is that we're on the lookout for another person to join our editorial team. Essential qualifications are several years' experience in high-technology journalism, preferably in the micro industry, a good appreciation of the uses and applications of microcomputers and the problems faced by those trying to use them, and a good working knowledge of currently available micro systems, both hardware and software. You also need a high tolerance to bad language, a liking for black coffee (real), unless you're prepared to buy your own milk, and a willingness to get stuck into all the boring bits — like reading galleys, answering readers' letters and phone calls, fending off over-eager PR persons and helping out with mundane admin-type work as and when required. We want you to write (*don't* ring) with a full CV and examples of recent work to: The Editor, *Personal Computer World*, 62 Oxford Street, London W1A 2HG, before the end of September. We're an equal opportunities employer, which means we'd prefer applications from nubile young . . . (*All right, that'll do — Ed*).

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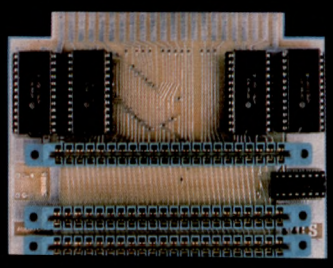

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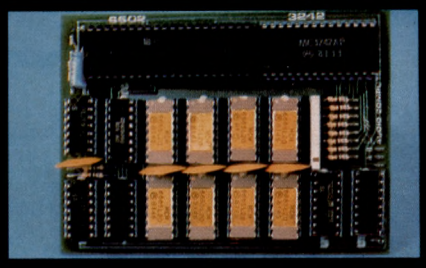

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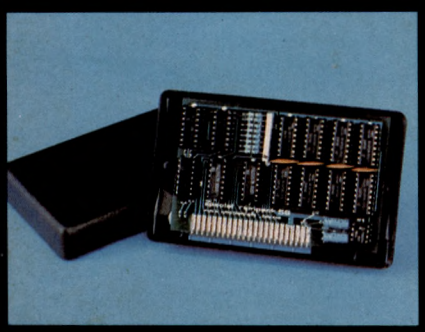

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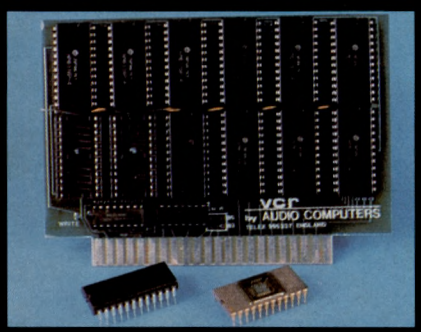

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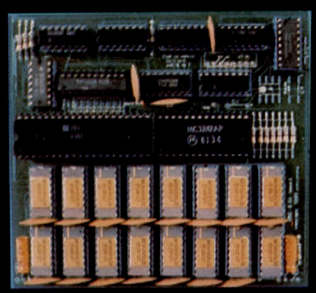

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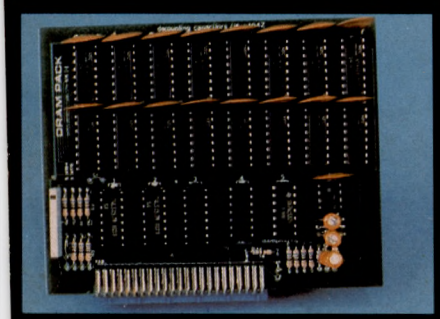

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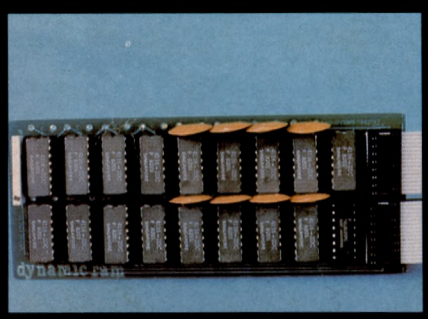

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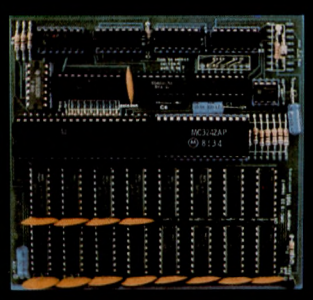

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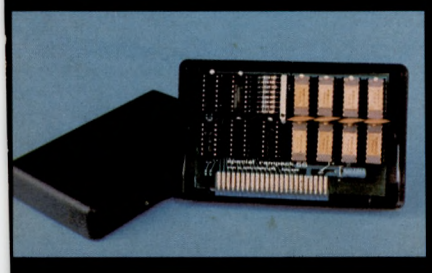

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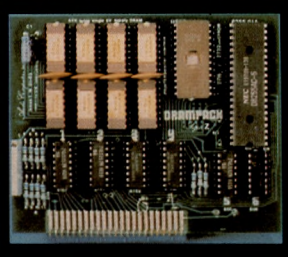

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